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Worm Adjustment by Displaced Contact

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Eccentric compensation for wear has several drawbacks when precision is important

IN WORM GEARING, present-day practice makes use of adjustment of center distances as a means for taking up wear and backlash. In many installations this means is amply suitable for the particular purpose, although introducing a differential error which will impair the accuracy and life of dividing mechanims of milling machines, gear cutting machinery, and other machine tool and measuring instruments. This differential error, that is to say, the error in velocity ratio existing in the motion from one wormwheel tooth to the next, is introduced in several ways by methods of adjustment which tend to destroy original accuracy and otherwise cause the adjustment to be short-lived.

The popular means for adjusting center distance is the eccentric bushing, whereby the rotating axis of the worm is revolved about a parallel axis. This circular motion of the worm axis resolves itself into two components:

1. The vertical component which shortens the center distance,

2. The horizontal which causes the worm axis to move across the face of the worm gear.

It is a well known fundamental in the art of gearing that proper conjugate action can only take place along the lines of action. In worm gearing, the lines of action for the various intersectional planes change in slope and magnitude as a function of the helix angle of the worm, and are shown in section *B-B*, Fig. 1, as *KK*, *K*, K_1.

It is probably because of the abundance of misinformation surrounding the subject of worm gearing that the rack action of involute spur gears was compared exactly to that of the worm gear. This is only true in one plane for a given direction of rotation and with the screw-type of worm occurs only in the plane containing the axis.

Further, from the geometry of the distorted helicoid, it will be recognized that in a worm gear the center distance, regardless of tooth form basis, cannot be altered from that at which it was generated if extreme precision in the differential velocity ratio is required. This axiom is founded on the fact that the lines of action cannot be straight in all parallel planes. It is evident from the foregoing that to minimize the error with the eccentric type of adjustment, the wormwheel face, unless on negligible helix angles, must necessarily be held to a minimum.

However, granting all necessary precaution, we cannot eliminate the most destructive error—that of improper contact, caused by adjusting center distance after wear has taken place. Fig. 2, a fragmentary section through the plane containing the axis of the worm set, exemplifies a worn wormwheel meshing at a corrected center distance to compensate for the worn faces. It is plainly visible that the only tooth contact in this plane is on the narrow unworn portion, which being inadequate to complete an entire tooth interval, alternately or simultaneously contacts at both worn and unworn portions. Its inability to contact at a correct line of action is virtually an interference which must cause errors in velocity ratio.

This condition is existent in any eccentric adjustment of worm gearing, regardless of the fineness and precision of manufacture, and to some measure explains the loss of accuracy of well made dividing mechanisms after some service.

As the helix angle of a given worm is a function of the diameter, it will also be apparent that, at the adjusted position, the unworn portion of the wheel is contacting a portion of the worm of different helix angle than that for which it had been cut. This tends toward cross-

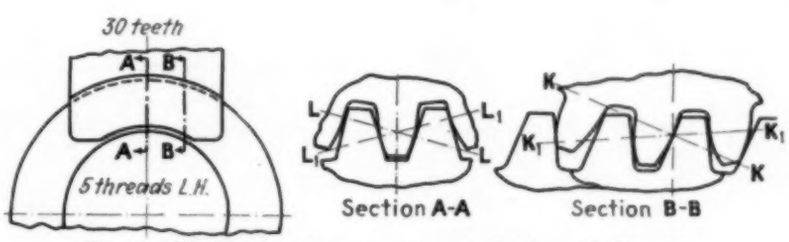


Fig. 1—Lines of action vary in magnitude and direction for different planes of intersection

bearing and point contact, both of which make for short-lived adjustment and destruction of the original accuracy of the worm gear.

Although minor, except on larger adjustments and helix angles, a further disadvantage of eccentric adjustments is the shift of the plane containing the axis of the worm as a result of the horizontal component of adjustment. As previously mentioned, the intersectional planes, as *A-A*, *B-B*, Fig. 1, have their own lines of action, the change of which is created by the geometric distortion of the helicoids. Any attempt to cause contact of one plane of one member with another of the mating member will result in deviation from the requisite of true conjugate action. Such a condition is shown exaggerated in Fig. 3, where plane *A-A* of the worm is in contact with section *B-B* of the wheel. With the numerous interferences as depicted in this view, no constant velocity ratio is possible.

In all of the above mentioned disadvantages, the conditions present a tendency to "wear out" rather than to "wear in"; that is to say, each subsequent adjustment presents a different condition and a tooth portion which does not take advantage of previous conformability by wear.

Displaced Contact

Fig. 4 shows a typical test curve on a worn wormwheel after adjustment with the eccentric compared with the same wormwheel used with the displaced contact adjustable worm. It is plainly visible that the differential error, although negligible in the wheel when new, has grown to a substantial degree after adjustment when compared with the displaced contact type of adjustment.

Additional disadvantage, imposed by the adjustable center distance as a means of compensation for wear, is the lack of definite location for the worm axis. This fact is appreciated by machine designers when attempting to attach a drive to this axis. The excessive clearance necessary at the roots of the threads and teeth to allow for radial adjustment, which is provided by an addition to the hob or the cutter diameter, causes additional undercut of the trochoid form as at *X* of section *B-B*, Fig. 1. This undercut is existent on higher tooth members than in spur gearing, basically because of the influence of the helix angle in reducing the "pressure angles" on one side of the worm thread.

A means of adjustment for worm gears whereby the original accuracy of the velocity ratio is maintained throughout the life of the gear, together with all the benefits of conformable wear and without any appreciable sacrifice of contact duration, is shown in Fig. 5, which

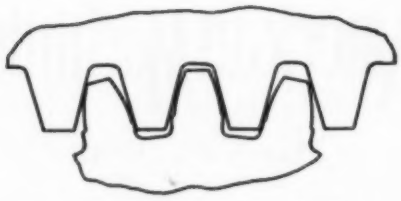


Fig. 2—Point contact results from radial adjustment after wear

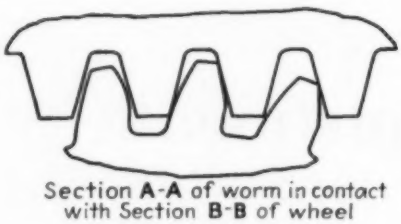


Fig. 3—Conjugate action of worm and wheel is impaired when the relation of intersectional planes is disturbed

utilizes a double worm adjusted axially be means of a single nut. The torque of the driving shaft *A*, Fig. 5, is transferred through spline keys to worm *B*. Clutch *C* provides a direct driving connection to worm *D* whereby a minimum amount of rotational backlash is transferred.

By means of the adjusting nut *E*, worm *D* is moved axially in relation to worm *B*. A G-spring *F* provides the necessary locking means by latching with adjusting nut *E*. Latch flutes *H* on the periphery of the nut provide the necessary fine increments of adjustment.

It may be said that this construction reduces the capacity because only half of the effective length of the worm is driving, but on closer analysis we will see that this need not be true.

The effective length of a worm is not the chord length JJ_1, Fig. 5, as mentioned in some text books, but rather the greatest length representing intersection of the outside diameter of the

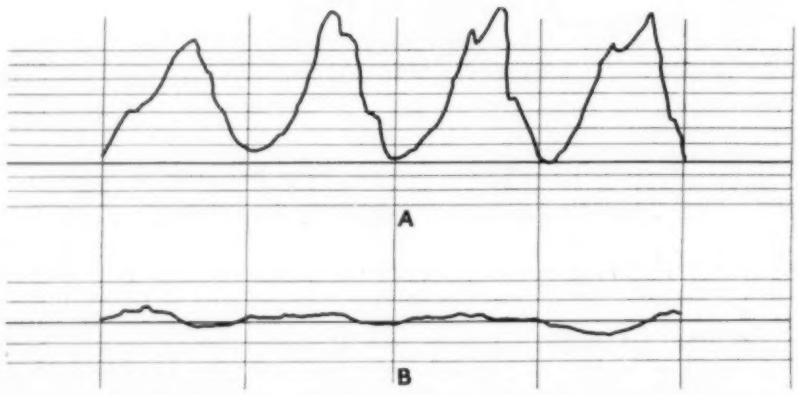


Fig. 4—Test curves show the difference in velocity variation between eccentric and displaced contact adjustment

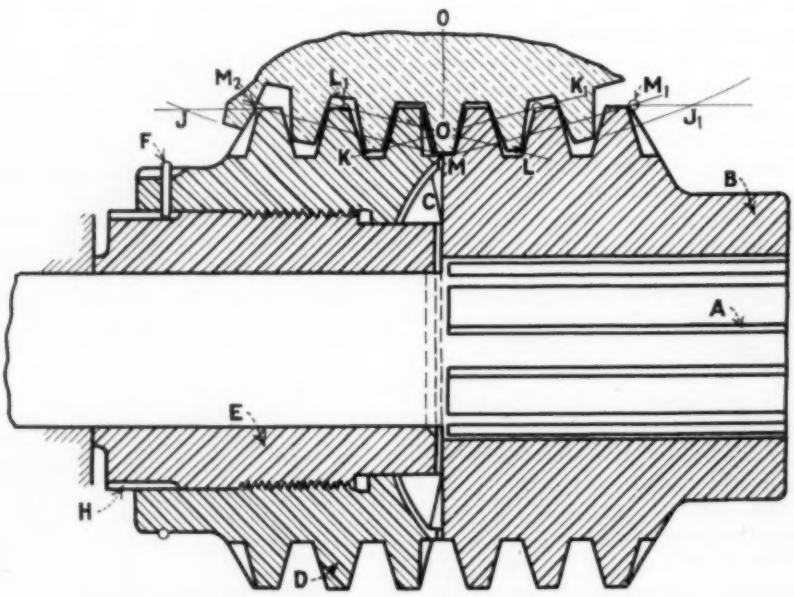


Fig. 5—Axial adjustment of half the worm does not necessarily reduce the length of the line of contact

wheel with the lines of action for one limit and the intersection of the outside diameter of worm with lines of action for other limit, as represented by the length KK_1 in Fig. 5, provided of course that the effective line is within the limit of conjugate action as explained in "Graphical Determination of Worm Gear Contact" (*Product Engineering*—Vol. 4, page 42).

To describe the tooth action occurring in a wormwheel of conventional tooth standard, we shall, for the purpose of simplicity, confine the following description to the plane containing the axis of an ordinary screw type worm with its straight line of action intersecting the centerline *O O* of Fig. 5 at the conventional pitch point position, as this will illustrate fully the essence of the analysis.

Shifting the Pitch Plane

Separating the two worms by the adjusting nut will reduce the line of action to *K O* for one direction and *L O* for the opposite direction of rotation, greatly reducing the contact length. By shifting the pitch plane to a position tangent to the root cylinder of the worm, as at *M*, the line of action is shifted to the right for one direction and to the left for the opposite direction, substantially as shown by the lines MM_1 and MM_2, interesting at the root cylinder. Causing these lines to intersect at the root circle of the worm then has the effect of receding the arc of contact so that the entire duration of action is confined to one of said worms for a given direction. Incidentally, with the combination in Fig. 5, an actual gain in contact length over the conventional line BB_1 is apparent.

The effect on the line of action in all planes of the worm is shown in Fig. 6, which by the shaded area *ABCD* outlines the zone of contact for a 40-tooth wormwheel having the conventional pitch plane position, the superimposed construction lines indicating the same zone for the reversed direction of rotation. It is plain to see that separating the double worm as in adjustment, the zone in Fig. 6 would be divided at the centerline *O* O_1 so that the effectiveness is materially reduced and confined to remaining zone position AOO_1C.

In comparison, Fig. 7 shows the zone of contact for the 40-tooth wormwheel as affected by the shift of the pitch plane tangent to the base cylinder of the worm. The zone shown by the shaded area AOO_1B of Fig. 6 is now shifted to that of recession so that action for the direction of rotation indicated by the arrow is confined entirely to the worm piece *H*. For the reversed direction of rotation, the zone is shifted 180 deg. about the centerline OO_1 in the plane of the paper, as shown by outline EOO_1F and is likewise confined to recess action in the companion worm piece *J*.

Shifting the zone of contact to affect a durable adjustable worm is by no means confined to the pitch plane position substantially at the root cylinder of the worm. With short center combinations of low helix angle, for example, positioning the pitch plane approximately tangent to the outside cylinder of the worm results in outstanding advantage as to tooth form and action which will be explained.

Irreversible Gearing

In certain mechanical combinations, it is desirable, if not necessary, to provide an irreversible worm gear of high capacity and life at a relatively short center distance. The difficulties encountered when attempting to do this are manifold, one of which is the deterimental undercut caused by the relatively low number of teeth. Irreversibility, as is well known, is attained by lowering both helix and pressure angles so that the resultant or gliding angle is less than the angle of repose for the entire worm set. With the helix angle a function of helix diameter and lead, relatively large worm and small wormwheels are the result when an adequate pitch or lead of thread is provided. Using the standard low pressure angles with these relatively small wheels, low capacity and in many cases disastrous results were evidenced as the outgrowth of undercut. Increasing the pressure angle to overcome partially this undercut increased the gliding angle and therefore decreased irreversibility.

In the present analysis, these difficulties have to a large degree been eliminated by shifting the pitch plane to substantially the outside cylinder of the worm. This shift is accomplished by proper valuation of the functions *C* and *P* in the conventional equation:

$$R = C - \frac{(N\,P)}{(2\,\pi)}$$

where R = distance of pitch plane from axis of worm, often called pitch radius of worm.
C = center distance,
N = number of teeth in wormwheel,
P = linear pitch of worm.

That is to say, for a given distance and number of teeth, a reduction of *P* increases *R* or shifts the plane outward in respect to the worm axis and vice versa. Conversely, for a given pitch and number of teeth, an increase of center distance is required to accomplish the same shift of plane.

The benefits derived by the shift of pitch plane, exclusive of its use in the adjustable worm, are mainly larger wormwheels and smaller worms for a given helix angle and center distance; the lack of any possible undercut; or if necessary, for a given worm and wheel diameter, a lower helix angle may be obtained. Both these points have a compound effect in attaining a long-lived and substantial irreversible worm of short centers.

It is common knowledge in the art of gearing that no conjugate action can take place below the base circle of involute spur gears. Worm gearing is closely associated with involute spur gears as regards principles of interference and undercut but unlike them has numerous varieties of pressure angles even in a single plane. Again, in relation to adjacent planes, no definite base circle is existent in the wheel, but rather an infinite number of parallel everchanging "base circles," which explains the presence of undercut on worm gears having tooth numbers for which spur

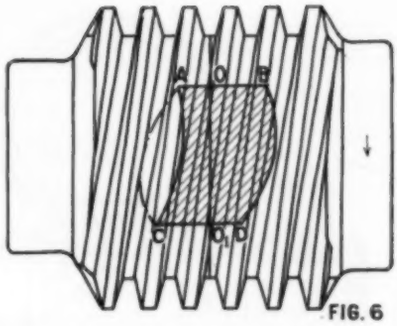


FIG. 6

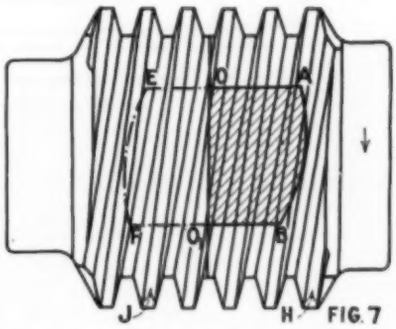


FIG. 7

Figs. 6 and 7—A shift in the plane of contact prevents reduction in the zone of contact when the double worm is adjusted

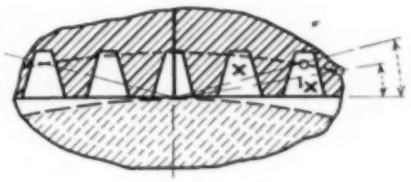


Fig. 8—A reduction in pressure angle aids irreversibility and increases the number of teeth in contact

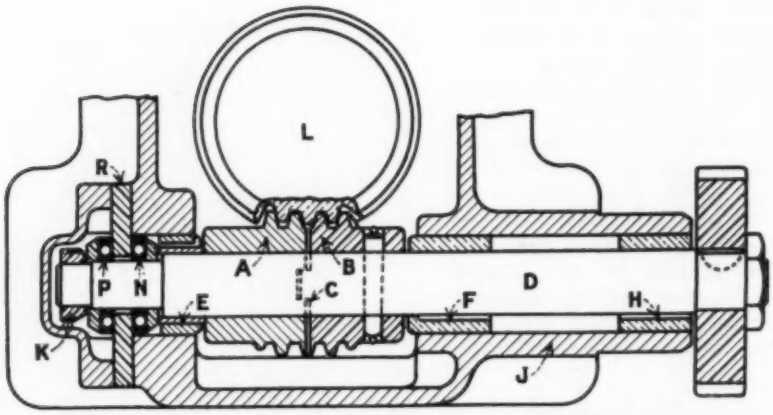


Fig. 9—Thrust bearing and worm may both be taken up by a single adjustment

gears of like pressure angle are immune to it.

With no undercut possible at the shifted plane position, a reduction of basic worm pressure angle can be inaugurated with its compound effect of aiding irreversibility and increasing the number of teeth in contact or duration of contact substantially as shown by the length of lines X and X_1 in Fig. 8.

The location of the pitch plane tangent to the outside cylinder or root cylinder has substantially the same effect as regards the necessary zone displacement of the adjustable split worm, except that in the latter case action is entirely confined to approach. Further with the pitch plane at this position, both members of the adjustable worm are now brought toward each other for adjustment, permitting wear and slack of both bearings and worms to be taken up by a single adjustment nut as illustrated in Fig. 9, which shows a center-plan section through a short-center irreversible worm drive in its preferred form. Worm *A* is keyed to worm *B* by means of tongue *C*, which allows for axial adjustment. Worm *B* is securely fastened to shaft *D* to prevent its rotational or axial movement. The feed shaft *D* is carried by three concentric bearings *E*, *F* and *H* in the main frame *J*. The adjustment of the worms is as follows:

Through the medium of nut *K*, shaft *D*, and worm *B* are brought to the left, causing a slight rotation of wormwheel *L*. This rotation, in turn, takes up lost motion and forces worm *A* through collar *M* to react at the thrust bearing *N*, thereby also taking up the lost motion in bearing *N*. In so doing, nut *K* takes up the lost motion in bearing *P* and reacts finally against thrust plate *R*. The driving tongue *C* may be supplanted in less precise installations by a single key or spline on shaft *D*. It is found that greater precision is possible with the tongue *C* mainly because of its greater acting radius.

"Yes" Men in Industry

HART F. WRIGHT

Much has been written in the past year about industrial organization, manufacturing efficiency, and executive policies, with an occasional jocular allusion to the "yes" men who infest the payrolls of many large concerns, apparently, for the purpose of impressing upon all and sundry, the infallibility of the big boss. The general idea is to create an atmosphere about the executive office, which will place on it such a halo of superiority that any ideas expressed, which might be contrary to those advanced by that office, would be treason.

I do not believe that such a condition is, in most cases, premeditated by the chief executive, but that it is started and built up by executives, who have been placed in positions of lesser importance and who, wishing to make an impression, find that the subtle flattery of unfailing agreement lends itself satisfactorily to that end.

It may seem unreasonable to suppose that any man, big enough to hold a responsible executive position, could be blind to such conditions in his organization. However, these conditions do exist in many instances and are possible because the trusted "yes" men are in positions between the chief executive and his several departments. They find it easy to intercept suggestions and complaints and are able to impress upon the contributors of these suggestions and complaints that such procedure is not acceptable in the front office.

One instance which came under my direct observation, a short time ago in one of the largest manufacturing plants of the South, was as follows: A new model of its product having been designed and a few experimental pieces started, a fixture to hold this part for one of the machining operations was hurriedly designed and built. It served the purpose in view of the fact that there were but a few pieces to be machined.

This new product showed promise of success, and it was decided to make a few of another size. When it came to the point of making a fixture for the same operation, the superintendent sent the first fixture to the toolroom with instructions to make one like it to fit the new part.

The toolmaker assigned to the job noticed that this fixture could be much improved, and calling his foreman, suggested improvements which would lower the cost of the fixture, and make it much more efficient in machining the part. The merit of these suggested changes was obvious to any practical mechanic, and the foreman agreed that they would greatly improve the fixture. But his answer to the toolmaker was, "Make it like the other one, you know how the boss is; if we make any suggestions, he'll get sore."

Personally, I don't believe any superintendent worthy of his job would get "sore" about a suggestion as good as that one, but would be pleased that men in his department showed an interest in the company's business, and were capable of thinking to such an advantage.

Coming back to the "yes" man. Why did the foreman turn down this suggestion? There was plenty of time to take it up with the superintendent before the stock arrived for the job, and no time would have been lost in the construction of the fixture; in fact, several hours would have been gained if the suggestions had been accepted.

Was this foreman really afraid that he would be made to suffer for suggesting an improvement, or was he afraid that the toolmaker might get some favorable notice that would reflect to his own disadvantage? Or did it go still further, in that this foreman knew that the superintendent feared to make any changes, or even to suggest improvements upon a fixture designed by an engineer, whose feelings might be hurt, and who might have a strong pull in the front office? Or was it the policy of both these men to avoid responsibility?

What's the answer?

The five sided broaches or reamers, originally made for watchmakers and jewelers for reaming sheet metal, are almost indispensable to die makers for reaming clearance in piercing dies. One serious drawback to their usefulness in die work is the difficulty in holding the tapered tang in a tap wrench. A die maker asks why some enterprising manufacturer does not get out a series of these broaches with shanks similar to those on standard tapered reamers.

A Machine Shop on Wheels

JOHN H. SHEEHAN

ABOUT three years ago business in Oneonta, N. Y., as well as elsewhere, had settled into a doze. Cobwebs grew in the local railway shops. A local mechanic, D. H. Mead, found little work coming his way so he rigged up a motorized machine shop and now rolls up to the work in it. And he is making a successful venture of it, too.

Mr. Mead built the shop shown in the accompanying photographs from the chassis up. It is 17 ft. 10 in. long and 7 ft. 3 in. wide. He then equipped it with a 9-in. South Bend lathe, of the quick change gear type, a Buffalo drill press, a bench grinder, a hand saw and a radio test panel.

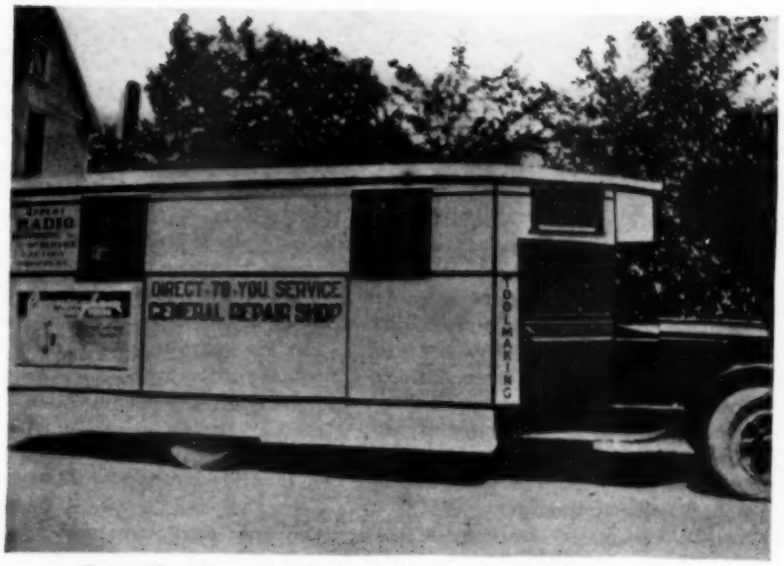
A 110-volt light plant supplies light and power for the shop. Living quarters are also provided.

To round out the equipment are several portable tools including a lawn mower grinder, a barber's clipper blade grinder, cut off and rip saw, and a complete acetylene welding outfit. With this array Mead adopted the slogan "We repair everything." He says:

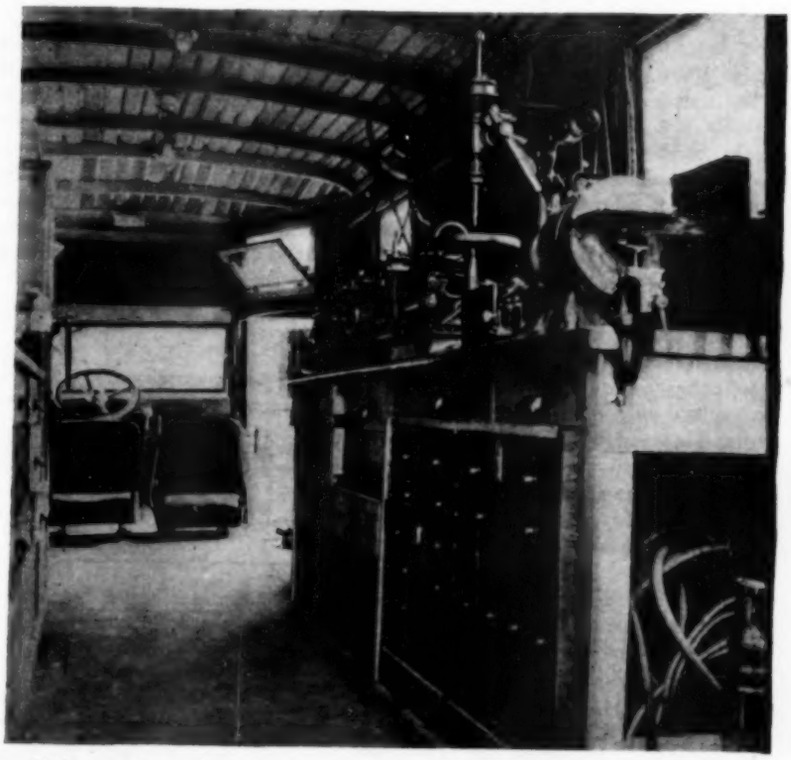
"I do anything that comes within the range and capacity of the tools. I weld auto blocks, fenders and frames; repair farm machinery and make new parts when necessary; repair guns and locks, and make keys. I grind cutters and reamers for country and small town garages and do all kinds of general machining work with my lathe. In addition, the advertising on my truck pays some revenue."

Mr. Mead left Oneonta in the summer of 1930. He worked leisurely through Pennsylvania. Small towns and farms provided so much work that this state could have been made a permanent workplace. The Carolinas were traversed during the autumn, and finally, in November, West Palm Beach was chosen for a semi-permanent wintering place.

Expenses are small—the 110-volt plant will operate the power equipment for six hours on a gallon of gas and ½ pint of oil. The truck itself will average ten miles to a gallon. This year Mr. Mead spent the winter in California.



From Florida to California this portable shop seeks the job



Living and working quarters are combined in a compact layout

Low Cost Tooling
Discussion

R. E. W. HARRISON
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WHILE I readily agree with Mr. Padgett's praise of welded jig and fixture structures and his enthusiasm for fixture design which assumes the responsibility for accuracy of alignment and center distances, I nevertheless believe that his remarks regarding the high cost of re-equipping with new machine tools infer a joint responsibility shared by the user as well as the machine tool manufacturer.

As Mr. Padgett so clearly points out in his paper, economics is always the deciding factor, and more often than not, the economic well-being of an installation, such as a line of production equipment intended to machine some specific job, is quite rigidly held in the hands of the user.

While this, in some respects, is as it should be, the economic balance which infers a reasonable profit on the operation is such a delicate matter in the days of enormous quantities (mass production) and fractional unit profits, that it would seem wise at times to cast a speculative and critical eye over the method and motive with which machine tool equipment is bought.

In other words, most machine tool makers are specialists in their own particular line, and while they individually may be credited with knowing all that is worth knowing about their particular specialties, this is not by any means the whole story, inasmuch as a production line involving say twenty types of machine tools must be regarded as a team with but one ultimate objective in mind —the lowest possible ultimate aggregate cost of the product.

To the writer's way of thinking, this team needs a trainer as well as a captain. Reduced to work-shop terms, this means that the line must be not only carefully designed to safeguard the economic balance, but its ultimate investment value must be safeguarded by injecting into the individual units of the line a degree of flexibility.

In the past, there has been a major obstacle to the achievement of this ideal imposed on the machine tool manufacturer by the buyer, inasmuch as it has been customary to throw the specialist groups into intense competition with each other and to award the order for each individual item in the line on the basis of return on immediate investment. The problem of ultimate return on investment has but seldom been taken into account; hence the average machine tool builder has strained every nerve to supply a super-productive tool designed for handling the specific operation on the particular piece at the moment under consideration.

That this policy should finally result in a disproportionate cost of changeover was a foregone conclusion; hence, I repeat, the remedy must come jointly from both user and supplier.

That the chief characteristic of the machine tool industry is a self-sacrificing ideal of service, no one who has bought much machine tool equipment will deny. Furthermore, the statistics pertaining to the industry clearly show that over a period of years its profits have been quite meager; hence, while the builders would like very much to meet Mr. Padgett's ideas on the subject of prices, it is doubtful if the overall cost of tool equipment will be materially reduced. Possibly one of the more acceptable ways of dealing with the situation would be to separate the charges for special development engineering work on machining problems from the charges for the actual machine tools and fixtures.

At present, it is not generally customary to split these two items, and the inference has apparently been drawn that equipment costs are on the high side.

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While connected with an automotive company in Michigan a number of years ago, I first realized the importance of welding equipment for toolrooms and thank *American Machinist* for its valuable assistance in publishing articles on this subject, particularly the editorial entitled "Equipment Costs" that immediately followed the above titled article. The statements may fail to harmonize with every reader's opinion, but the editors are practical with an opportunity to study present-day problems from every angle, while we are laboring in a small circle.

When designing tools for the assembly of parts by spot welding, there are three fundamental rules that govern their efficiency: clearance for the electrodes, over-all weight and low cost of construction. While the designs presented are quite similar, there is enough difference to make the comparison interesting to

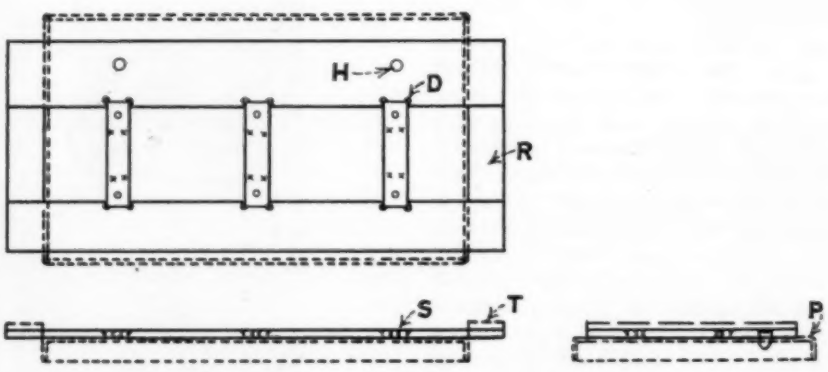


Fig. 1—Time and weight are saved in using welded construction on this locating jig

A paper presented by J. E. Padgett, assistant general manager of the Spicer Manufacturing Corporation, and abstracted in *American Machinist* (Vol. 77, page 82) stimulated these three discussions.

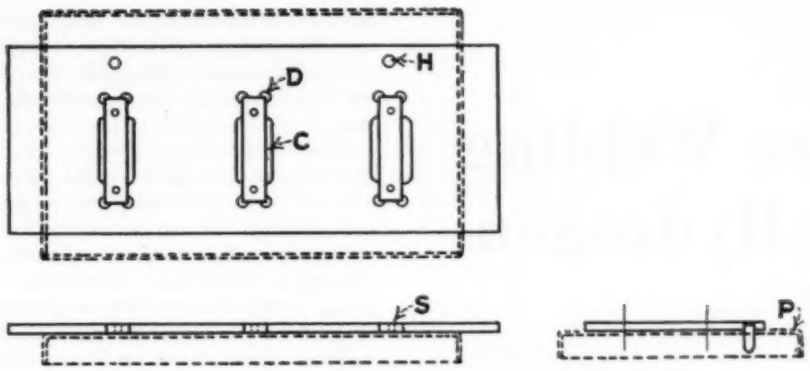


Fig. 2—A jig for the purpose shown in Fig. 1, made without welding, requires careful hand fitting

the reader as a simple, practical and tried-out problem has been selected.

A study of the accompanying illustration shows fixtures for a spot-welding operation. The purpose of the fixtures is to locate three pads *S* in relation to the two holes *H* pierced in the pan *P*. These pads are spot-welded to the pan shown by the welding symbol *X*.

To accomplish this operation, shown in Fig. 1, two cold-rolled steel bars ⅛ x 1¼ in. are cut to length, clamped together, clearance drilled *D*, milled to suit the width of straps *R* and tied by two cold-rolled steel bars ⅛ x 1 in. in length to suit spacers (should electric or gas welding be used) or tie straps *T* (should spot welding be used). These are assembled by welding as shown; two pins locate the pan in relation to the straps. One of these locating pins is elliptical to aid in loading and unloading.

The constructional features of the fixture by the welded process is the eliminating of hand labor, generous clearance for electrodes, and minimum weight.

Fig. 2 shows a design commonly used when welding equipment is not available in the toolroom and omits the fundamental requirements of a spot-welding fixture. This fixture handles the same problem described previously. A cold-rolled steel bar ⅛x4 in. is cut to length, clearance drilled and the openings machined. There is a considerable amount of costly hand labor in fitting the nests for the straps. The amount of clearance for the electrodes is governed by machining, which adds to the cost of construction, and the unnecessary weight adds to the inefficiency of this design.

A problem was solved recently that should help install welding equipment in every toolroom. A large bracket to be drilled called for a drill jig of unusual size and complication; because of these conditions, a jig by the welded process was recommended and sketched. All of the machining could be handled with present toolroom equipment with the exception of four holes to be bored in line for the main bearing drill bushings. The jig was constructed and rest pads machined, all holes bored and drill bushings placed, allowing room to support the main bearing bushing plates to be located in line and welded in assembly; all clamps were built and assembled to the jig.

A model was machined in accordance to engineering design and clamped in the jig. A shaft of required length was ground to suit and assembled through the bearings of the bracket. Four bushing plates were cut to length, bored and the drill bushings pressed in. These plates were placed on the ground shaft at their respective positions in the jig and tacked, then welded, causing no distortion to the jig or plates and with considerable less time and expense than had they been bored in the jig. All danger of distortion when pressing in the drill bushings was eliminated. The jig is in production now making the parts in accordance with necessary engineering requirements.

Thanks to Mr. Padgett and *American Machinist* for the article which gives a general picture of the methods now in use and which should be studied to advantage by both tool engineers and management.

C. G. WILLIAMS

Consulting Mechanical Engineer

Mr. Padgett's criticism of the set-up in those shops where there is a preponderance of automatic machinery and his banking analogy are both timely; however, there is without doubt a great place in industry for the highly developed, fully automatic machine, but the decision when to install this type of manufacturing equipment is definitely tied in with the policy of the buying company.

Quite frequently, in normal times, the cost of automatic machinery can be amortized long before the job dies, and where this can be done, the wise executive usually takes his courage in both hands and does it.

Mr. Padgett is entitled to the thanks of all of those devoting time, money, and a lot of thought to the problems of manufacturing industry, and his paper is but another indication of the need for some new thinking all around, especially when it is realized that more than 50 per cent of the machine tool equipment in existence today is over ten years old, and from 30 to 80 per cent inefficient on a full production basis when measured against the performance of the latest types of equipment.

Mr. Padgett's paper has much to commend it, but to a machine tool designer, especially a designer of jigs and fixtures to accompany machine tools, there is much that can be added and subtracted.

Let us first refer to the groups of miscellaneous clamping fixtures shown in Fig. 1. I would take exception to all of them and for the same reason. They take too long to load. The machine tool is not working as much as it should. In every design of fixture, the designer should always consider the ratio of cutting time to loading time, which includes unloading time also. Setting up a screw clamp takes too long. These fixtures should all be locked with a lever or cam at one movement.

As to the reduction of prices, there is a peculiar analogy connected with such a course. Good work, accurate work, costs money and most, but not all, makers of machine tools recognize this—also that the machine tool and fixture must be more accurate than the piece to be machined.

If a piece has a tolerance of 0.002 in., that is, plus or minus 0.001 in., the jig must be held to a tolerance of 0.001 in., or plus or minus 0.0005 in., while the machine tool should be held to an equal or less tolerance than the fixture, else the excess spoilage will cause machine and fixture to be condemned.

The cheap tool cannot be held to these tolerances, and the purchasing agent has been bitten so often that he is not favorably inclined toward the cheap tool. We should weld wherever possible, if thereby the fixture can be made more cheaply (and by the way, I have welded cast iron parts into a fixture more rigid than steel would have been and fully strong enough for the purpose), but I believe that we should study closely the possibilities of various metals before we make a decision either way.

Correction

In an article, "Carbide Cutters for Face Milling" (*AM*—Vol. 77, page 10), milling cutter feed is erroneously given as 1.010 in. in the first paragraph of column 2. The correct feed is 0.010 in.

Automatic Arc Welding with Atomic Hydrogen

J. T. CATLETT
General Electric Company

THE ATOMIC hydrogen process has been applied to hand welding since the early part of 1927. While several improvements have been incorporated in recent models, the apparatus for hand welding remains essentially the same. The first automatic machine was demonstrated at the National Metals Exposition at Chicago in September, 1930.

Alternating current is introduced to the electrode holder through a variable reactor, the materials to be welded forming no part of the circuit. The electrode holder carries two tungsten electrodes which are surrounded by an atmosphere of hydrogen. The arc is struck between the two electrodes and takes the fan-shaped form shown in Fig. 1. The hydrogen absorbs energy as it passes through the arc and is converted from molecular hydrogen to atomic hydrogen. In this state the gas is unstable and tends to reunite as soon as it leaves the arc-stream. Contact with a relatively cold surface intensifies this tendency. In reunion the energy previously absorbed is released in the form of heat. In practice the lower edge of the fan-shaped arc is applied to the materials to be welded, the heat released by the recombination of the hydrogen being used to fuse the metals.

The amount of heat delivered to the metal depends on several factors. Taps on the reactor allow a range of current selection, and the current used is determined by the material being welded. With any particular setting, the actual current obtained decreases with an increase in the arc voltage, or increase in the distance between electrodes. The extent of this decrease is shown in Fig. 2, which is an approximate vector diagram of the arc and reactor voltages, the welding current being directly proportional to the reactor voltage. With a normal arc voltage of 70 volts, a 10 per cent increase results in a 2 per cent decrease in the current. The heat available in the flame is almost directly proportional to the current. A second factor is the distance from the arc to the work. Variations in this distance will change considerably the amount of heat applied. The third factor is the speed of welding. Obviously, decreasing the welding speed increases the total amount of heat applied at a particular point. In hand welding, the proper consideration of these factors, and the compensation for changes in one by equivalent changes in the others are the principal elements in welding skill.

These same factors, which in hand welding are controlled by the operator, are present in automatic atomic hydrogen welding, but it is impractical to change any factor to compensate for changes in the others. Therefore, variations in all factors must be eliminated or reduced to a minimum. Uniform welding speed and uniform distance from the arc to the work enter into the design of the machine which produces relative motion o fthe arc and the work. A sensitive voltage relay actuated by the arc voltage causes a motor in the welding head to keep the electrodes properly spaced. This reduces the changes in current to a minimum.

For hand welding the majority of applications require current values less

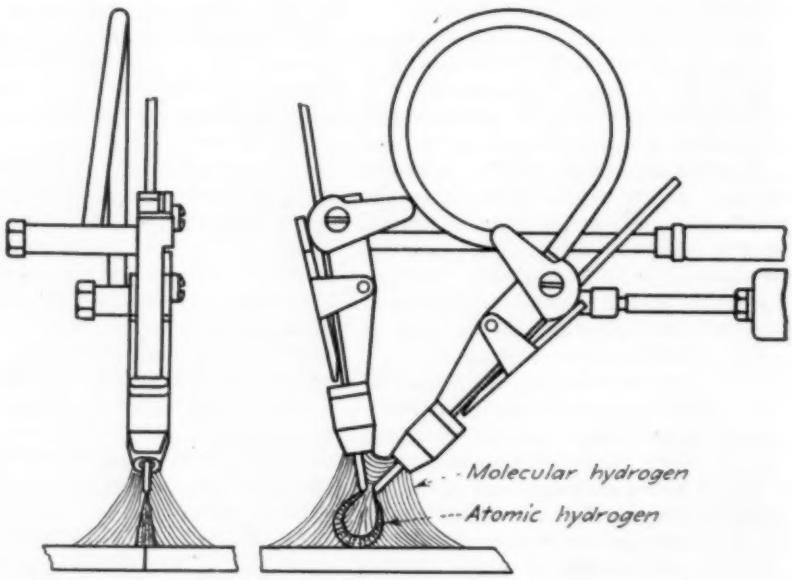
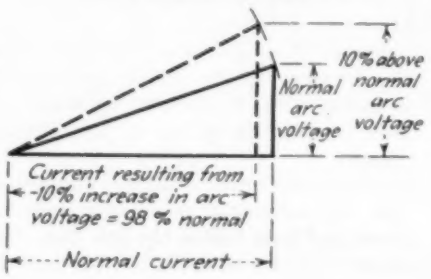


Fig. 1—Above—Atomic hydrogen is formed by the action of the electric arc within the gaseous atmosphere

Fig. 2—Below—An arc voltage above normal results in an actual decrease in current


10% above normal arc voltage
Normal arc voltage
Current resulting from 10% increase in arc voltage = 98 % normal
Normal current

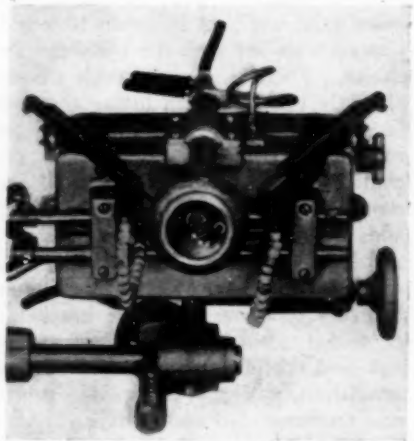


Fig. 3—Stability of the arc flame is obtained by throwing the electrodes out of line

than 75 amp., and the electrodes used are ⅛ in. diameter and less. Under these conditions the plane of the arc is approximately the same as the plane of the electrodes although there is some tendency for the flame to oscillate around the center line between the two electrodes. For automatic welding, the current range is from 50 to 175 amp., and as a general rule, ⅛-in. diameter electrodes are used. Under these conditions, if the electrodes are held in the same plane, the oscillations are so erratic as to make automatic welding impossible. By throwing the electrodes out of the same plane, as shown in Fig. 3, the arc flame becomes stable and takes a position at right angles to the plane of the electrodes. Stability in this plane is maintained by the electro-magnetic field produced by the arc current. As the amount of this offset depends on the value of the current being used, a manual adjustment of this offset is provided.

Voltage Control

The electrical circuit in Fig. 4 shows the voltage regulator and the electrode driving motor connected into the circuit. The adjusting rheostat makes it possible to hold different arc voltages as desired. The electrode driving motor is of the split field series type. As the arc voltage increases above normal, the regulator causes the motor to drive the electrodes together, decreasing the voltage. A decrease of the arc voltage below normal has the opposite effect.

The complete equipment consists of a clamping device or fixture, a travel carriage for obtaining uniform motion along the weld, a welding head, a wire feeding device for adding filler wire to the weld when desired, a power control panel, an arc control panel and a transformer. The clamping device and travel carriage are similar to those used for metallic arc welding and serve to hold the work firmly in position and produce relative motion between the work and the arc.

Due to the heat liberated by the arc, the nozzle which projects the hydrogen shield around the electrodes and the base casting supporting it are water cooled. The electrode carriers are driven simultaneously, through gearing, by a motor which is inclosed in the body of the head.

Hydrogen enters through two hose connections at the top of the nozzle shaft and is led to the bottom where it escapes through two jets into the expanded portion of the nozzle. This construction can be better seen by referring to Fig. 3. One jet is clearly visible in the center. The other is a circular slot so arranged that the gas escapes in a slightly conical envelope

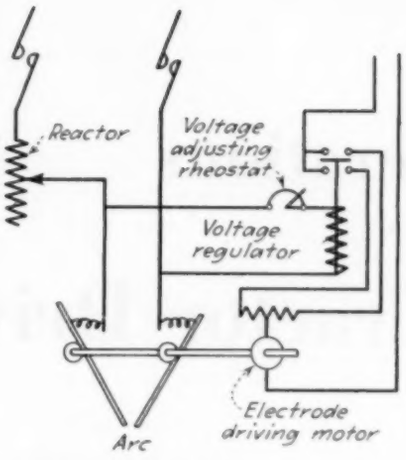


Fig. 4—The voltage regulator and electrode driving motor are connected into the circuit as shown

and is thrown against the sides of the nozzle and deflected downward. The result of the two jets is a low velocity, but relatively stable, flame of gas which completely surrounds the electrodes and the arc which flows between them.

The wire feeder illustrated in Fig. 5 is a late model. A variable speed motor operating through reduction gearing drives the filler wire at constant speed into the fringe of the arc. The guiding nozzle is adjustable at right angles to the seam so that the wire may be fed into the proper place. The desired height of bead may be obtained by varying both the size of wire used and the speed with which it is fed into the arc.

Application of this equipment is limited to that class of work where uniform relative motion between the arc and the work can be obtained. With few exceptions, the joint is either a longitudinal seam, straight in both horizontal and vertical planes or a circular seam lying wholly in one plane. As a general rule, any of the common types of joint, butt, lap, edge, corner or fillet,

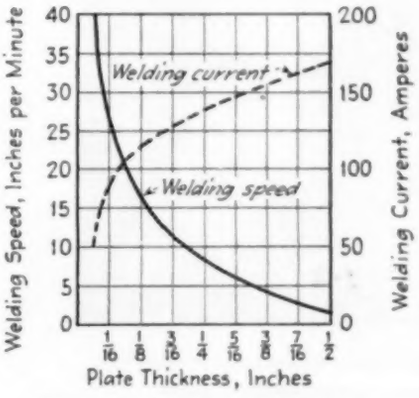


Fig. 6—Relation of welding current and speed to plate thickness for mild steel

Fig. 5—Filler wire is fed at constant speed into the fringe of the arc

may be used. In the case of the corner or the fillet weld, it is generally desirable to arrange the work so that the pool of molten metal is horizontal. This is also true of lap welds on thicknesses of a quarter of an inch or more. Filler wire is not used on material less than ⅛ in. thick and is usually desirable on material above ¼ in. thick.

While there are exceptions, materials thinner than 20 gage do not offer good applications. It is virtually impossible to prevent a slight warping when heat is applied. This causes one edge to pull away from the other at intervals and a poor weld results. Experience has not located as definitely the upper limit. Steel plate as heavy as ⅜ in. has been welded without beveling and ½ in. plate with a 60-deg. double bevel has been welded with a single pass. Three-quarter inch plate seems to require several passes. An idea of the welding current used and the speeds obtainable on mild steel plate may be obtained from Fig. 6.

As the application of this process to automatic welding is recent, experience is necessarily lacking, and its full possibilities have not been revealed. Stainless steel, brass and aluminum can be successfully welded. Welding current and speed differ considerably from the values used with steel. Indications are that the process may be extended to other applications.

Automatic Operations

On a Tractor Drive Hub

J. H. JOHNSON
Jones & Lamson Machine Company

Multiple tools arranged in four well planned set-ups result in efficient machine operations

THREE 24-in. Fay lathes and one double-end Fay automatic reaming machine are used to machine a tractor drive hub completely preparatory to grinding two outside diameters. The sequence of operations follows:

1. Machine long end as follows: rough and finish bore inside diameters; rough and semi-finish turn outside diameters; rough and semi-finish face shoulders; and cut 0.197-in. groove in the inside.

2. Machine short end as follows: rough and finish bore inside diameters; rough and semi-finish turn outside diameters; and rough and semi-finish face shoulders.

3. Ream inside diameters on both ends and finish inside shoulders.

4. Finish turn and face outside completely.

Fig. 2 shows the first operation. The operator mounts the casting in a heavy-duty three-jaw air-operated chuck; the jaws grip the 12-in. rough cast diameter and locate against the shoulder at the end of this diameter. The jaws used on this chuck are fitted with hardened serrated clips which are easily replaced when the driving serrations become worn.

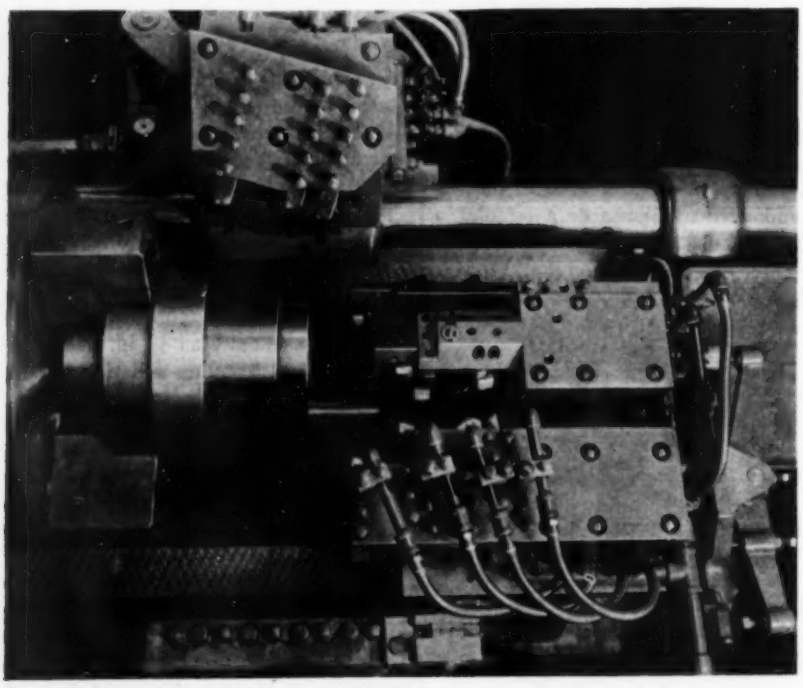


Fig. 2—On the first operation the front carriage is controlled by a set of upper and lower double-control guide formers mounted on the front lower slide. The formers are provided with two steps—one which guides the carriage for the roughing cuts and the other for the finishing cuts

When the work has been chucked, the operator starts the machine, and the front carriage and back arm move up in fast motion to bring the roughing tools into cutting position. The rough turning tools *A*, *B* and *C*, Fig. 3, are mounted on the back of the front carriage. Tool *A* rough turns part of the 12.008-in. diameter, and *B* and *C* rough turn the 7.904 and 7.277-in. diameters respectively. At the same time, tools *D* and *E*, mounted in a bar on the front carriage, rough bore the inside diameters of 5.787, 6.6896 and 6.742 in. Tools *H*, *J* and *K*, mounted on the back arm, rough face the shoulders and the end of the piece during the carriage turning time.

After the roughing cuts are completed, the machine goes into fast motion returning the front carriage and back arm part way. The carriage then rocks forward in fast motion to bring the semi-finish turning and finish boring tools into cutting position, and the auxiliary slide, mounted on the back arm underneath the roughing tools, brings the semi-finish facing tools into position to start cutting. The spindle speed is now increased for the remaining cuts. Tools *L*, *M* and *N*, Fig. 3, semi-finish turn the 12.008, 7.904 and 7.277-in. diameters, respectively, while tools *O* and *P* finish bore the inside diameters of 6.6896 and 6.742 in. The 5.787 in. diameter is rough bored only. During this time, tools *S*, *T* and *V* semi-finish face shoulders and the end of the work. Tools *W*, *X* and *Y* break the sharp corners.

The finishing cuts having been completed, the turning and boring tools are relieved by moving the front former slide, which is set on a slight angle, so that these tools will not score the work when returning. Tool *Z* then cuts the 0.197-in. groove. This tool is mounted

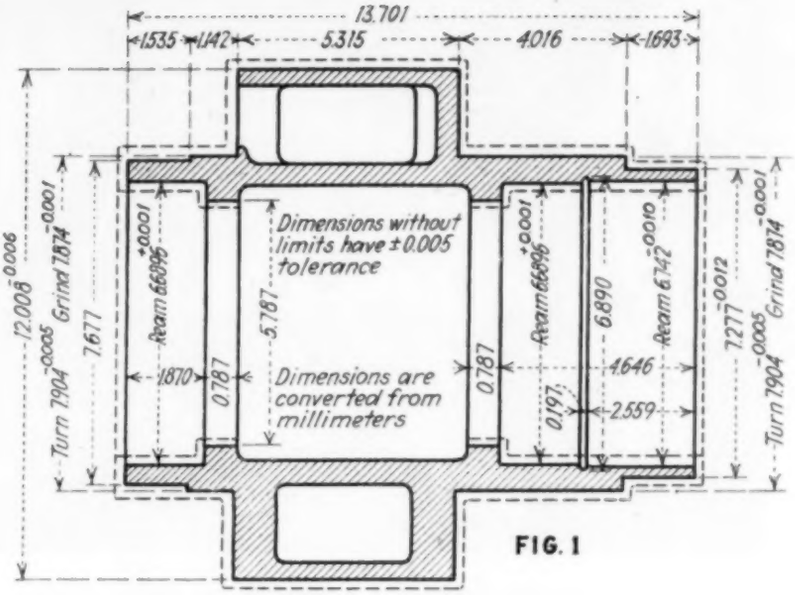


FIG. 1

Fig. 1—Approximately ¼-in. of stock is to be removed from all machined surfaces of the malleable iron hub as shown by the dotted lines inside and out

Fig. 3—A machining time of 5.2 min. is obtained on this operation, and a total idle time of 12 sec. is allowed, making the time to knock off 5.4 min. Fig. 5—For the second operation the machining time is 5.65 min., and the idle time allowed is 12 sec., making the time to knock off 5.85 min.

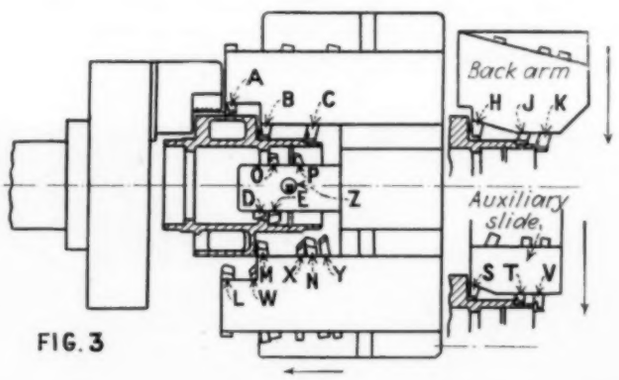


FIG. 3

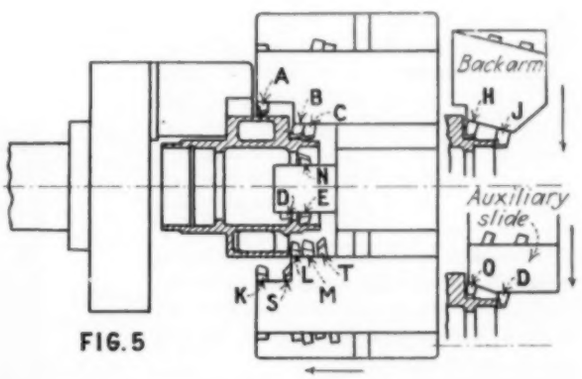


FIG. 5

in a bar which is carried by the boring bar and is operated through a linkage from the front former slide. When the grooving cut is finished, the machine goes into fast motion again, the grooving tool recedes, the carriage and back arm return well out of the way to facilitate removing the work and the machine stops.

The boring bar, the tool blocks for the rough turning and rough facing tools and the auxiliary facing slide are drilled to provide an adequate supply of cutting compound to the cutting points of the various tools. Cutting compound is delivered to the finish turning tools through individual flexible tubes.

High-speed steel tools are used on all of these operations, because the material is to be changed from malleable iron to steel castings which will be available as soon as the machines go into regular production.

After the first operation, the operator removes the hub and transfers it to another 24-in. Fay automatic lathe for the second operation, Fig. 4. The piece is reversed and chucked on the part of the 12.008-in. diameter machined in the

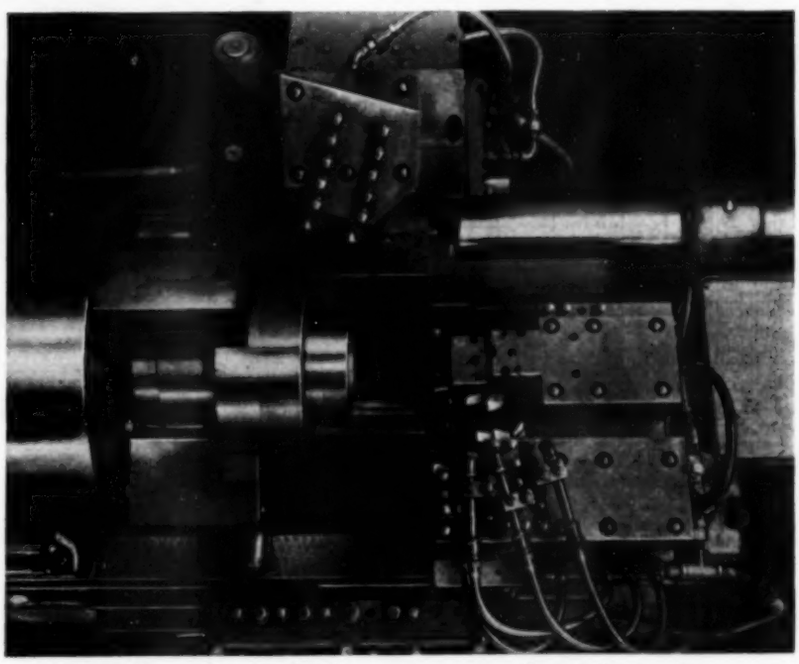


Fig. 4—When the finishing cuts are completed, the turning and boring tools are withdrawn to prevent scoring the work as the carriage and back arm return in fast motion to their starting positions and the machine stops

first setting. Location is taken against the machined shoulder at the end of the 12.008-in. diameter.

The same type of chuck is used, and the chuck jaws are provided with hardened and ground clips for properly gripping and driving the work.

When the work has been mounted in the chuck, the operator starts this machine which is tooled as in Fig. 5. Fast motion conveys the front carriage and back arm up to the work, bringing the roughing tools into cutting position. Tools *A*, *B* and *C* on the back of the carriage rough turn the 12.008, 7.904 and 7.677-in. diameters. Tools *D* and *E*, mounted in a bar, rough bore the 5.787 and 6.6896-in. inside diameters. Tools *H* and *J* on the back arm rough face the shoulder and end of the casting. The carriage and back arm then return part way, in fast motion, the carriage rocks forward and the auxiliary slide moves in, carrying the finishing tools into cutting position. The spindle speed is now stepped up for the rest of the operation. Tools *K*, *L* and *M* semi-finish turn the outside diameters. Tool *N* finish bores the 6.6896 inside diameter and tools *O* and *P* semi-finish face the shoulder and the end of the hub. The 5.787-in. inside diameter in this end also is rough bored only. Tools *S* and *T* break sharp corners.

The front carriage on this setting is controlled in the same manner as in the first operation; cutting compound is delivered in the same way to the cutting points of all the tools.

Reaming is Automatic

The work is now ready to be reamed, and the operator removes it from the chuck and mounts it in the dual hinge fixture in the double-end Fay automatic reaming machine shown in Fig. 6.

The holding fixture is equiped with hardened and ground pads giving a three-point bearing on the 7.904-in. diameter on both ends. Location endwise is taken against a hardened and ground block mounted on the inner side of the lower half of the right hand clamp. This locating block has a projection that engages one of the cored slots in the 12.008-in. face to prevent the piece from turning. To keep the hub against the locating block, a screw is provided which is tightened against the other 12.008-in. face.

When the hub has been properly located and clamps tightened, the operator starts the lower left-hand motor. This immediately throws the cam drums into fast motion, and both heads move toward the work, bringing the reamers into position to start cutting.

The machine now goes into feed, the two 6.6896 and 6.742-in. diameters are reamed, and the inside shoulders at the end of the 6.6896-in. diameters are finished. When these cuts are completed, the heads are automatically returned in fast motion to the starting position, and the feed motor stops.

The reaming spindles do not stop automatically and therefore revolve continuously as long as the motors on each head are running. These motors, however, can be stopped and started at will by the operator, push button controls being provided on the front side of the right hand head for this purpose.

The reamers used on this setting are mounted on piloted bars which are drilled to furnish an ample supply of cutting compound to the various blades.

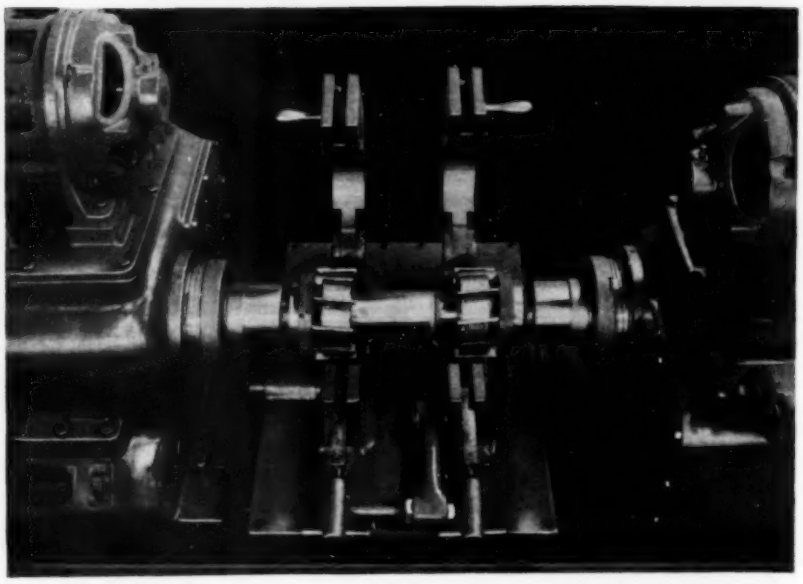


Fig. 6—For setting the reamers a swinging pin gage is used. The pin is of the proper length so that a 0.005-in. feeler is used between its ends and the front of the reamer blades. The reamers are located by adjusting the heads of the machine, and positive stops are set to prevent overtravel

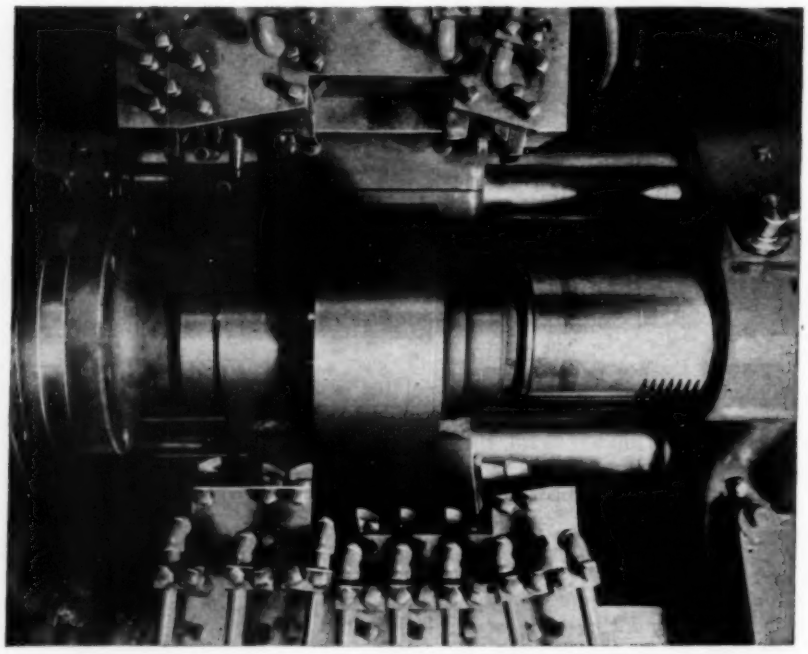


Fig 7—In the fourth operation, all of the outside diameters are finish turned using eight tools mounted on the front carriage. All shoulders including both ends of the hub are finished faced and all sharp corners are chamfered using nine tools mounted on the back arm

From 0.010 to 0.012-in. stock is allowed on the diameters, and approximately the same amount on the shoulders for the reaming operation. A floor to floor time of 1 min. 50 sec. was obtained.

The operator now transfers the work to the finish turning operation which is handled on a 24x24-in. Fay automatic lathe equipped with air-operated collet type fixtures on the headstock and tailstock spindles.

The operator mounts the hub on the fixtures which grip the 6.6896-in. reamed diameters. Location is taken on the headstock fixture which registers against the inside shoulder at the end of the 6.6896-in. diameter in the long end. The tailstock fixture registers against the inside shoulder in the other end to hold the work in position.

When the operator starts the machine, the front carriage and back arm rock in simultaneously in fast motion bringing the tools into cutting position. As soon as the tools finish cutting, the turning tools are lifted to prevent scoring the work, as the carriage and back arm return in fast motion to the starting position and the machine stops.

The cutting time on this operation is 2.5 min., the idle time is 6 sec. making the time to knock off 2.6 min. The hub is now ready to be conveyed to a drilling operation and a subsequent grinding operation where the 7.904-in. turned diameters are ground to 7.874 in.

When Belts Go Back to Work

J. N. SMITH
Engineering Department
E. F. Houghton & Company

Undoubtedly many plants have dozens of belts which have stood idle for some time. Before this belting is put back into service, it should be carefully inspected and reconditioned if necessary. Belting often deteriorates more rapidly when idle than when in regular use. In addition, many things can happen to an idle belt, and invariably the belt will need some attention to place it is first-class condition.

Below are a few conditions which should be checked:

Is the belt saturated with oil or covered with dirt?

Are there any open laps?

Is the length correct?

Are fasteners worn or broken?

Are pulleys properly aligned?

If belts have become soaked with mineral oil, degrease them by soaking in gasoline or carbon tetrachloride for 24 hours, longer if necessary. In doing this it must be remembered that the degreasing removes not only all mineral oil but also the natural oil which is essential to lubricate the fibers of the leather. Therefore, after the belt has been thoroughly degreased, dress it with a good belt lubricant to preserve the fibers.

Never permit foreign matter such as lumps of belt dressing, dirt, wood chips or adhesive material of any kind to gather on the belting or pulley faces. Clean the belt off by scraping with a dull edged scraper with rounded corners. Do not use a sharp scraper as the fibers of a belt must not be injured.

Check all the laps, and see that they have not started to separate, especially the tip of the lap. If it is found necessary to recement a lap, be sure to scrape off all of the old cement. The laps should then be thoroughly roughened up, either with coarse emery cloth, a rasp or wire brush before the cement is applied to the surface.

A belt which has been left on an idle drive under tension has no doubt become permanently stretched. Therefore it is wise to remove the belt from the drive and shorten it to the proper length to give the desired tension. If the drive is to be idle for some time do not install the belt on the drive tight. It is better not to install the belt at all until it is needed.

Fasteners of all types should be gone over carefully. If any of them are either worn or broken they should be replaced immediately. A worn fastener is likely to let go at any time. A broken fastener will not only cause the belt to run crooked but also damage wood or composition pulleys.

Pulley alignment is important from the standpoint of belt life and transmission efficiency as well as the operator's safety. It should be carefully checked during belting inspection.

The application, maintenance and repair of belting should be in the hands of a competent man trained in this service. Many good belts have been ruined by incompetent repairs. If your plant does not have the facilities for properly reconditioning your belting any reliable belt manufacturer can do this work for you. You will then receive the best job that good workmanship can produce and your machines will be ready when production starts.

Wastes That Cost Money
Discussion

HARRY SHAW
Consulting Engineer
Heywood, Lancashire, England

In an article under the title given above (*AM*—Vol. 76, page 935), George Wintritz states that often shafts far greater in diameter than is necessary to transmit the required power are to be seen in machinery, and that this is waste.

Often the power to be transmitted does not control sizes, but the necessity for making a part strong enough to withstand the extra strain put upon it by the careless or thoughtless acts of the human machine does. In some places, ⅛-in. bolts might be quite strong enough for certain purposes, but because of the tendency of workmen to tighten bolts extremely tight, it is necessary to use ⅜- or ½-in. bolts to withstand this tightening, otherwise the threads would be stripped or the bolts be broken.

The story is told of a university-trained man who took his preliminary plan of a machine rather similar to a lathe, in that it had a lead screw, to his chief for inspection, and the following conversation took place:

Chief: "That lead screw is not large enough. Make it at least 1½-in. in diameter."

Designer: "But Mr. Blank, this ½-in. screw will be quite big enough to transmit the required power. I have calculated the maximum stress to which it will be subjected by sudden loads, and it is big enough to resist them."

Here he produced several sheets of calculations in which calculus had been freely used.

Chief: "No doubt a ¼-in. shaft would be strong enough to transmit the power, but you have forgotten one thing. If an electric lamp above that machine failed, the workman would probably stand on the bed of the machine to put in a new one, and in doing so he would probably use that lead screw as a step when he climbed onto the bed. Therefore, make it at least 1½ in. to withstand his weight."

In design, one must take into consideration the human equation as being as important as the factor of safety.

Professor Sweet once said in the columns of the *American Machinist*, "We calculate the stress to be so many pounds, so many ounces, and then we add ten tons for safety, multiply the result by five, add a hundred tons for luck, and then make the machine strong enough to withstand that stress," or words to that effect.

Relief of Formed Milling Cutters—II

RONALD V. HUTCHINSON

Production Engineer,
General Aviation Manufacturing Corporation

FOR 14-, 16-, and 18-in. lathes, the writer has found the following relationship to hold in general, for roughing out with non-raked form relieving tools:

$N \times S^2 \times s \times l \leqq 650$, for the avoidance of trouble where:

N = No. of teeth in cutter being relieved.
S = r.p.m. of workpiece.
s = stroke of relieving slide in inches.
l = length of tool cutting faces, in inches.

For finishing, the workspeed should be slow, but in general, this is a matter of relatively little moment, as the speeding up of the roughing part of the forming permits the profitable use of a little more time in finishing.

Gashing of Cutters

Gashing and relieving are really interconnected. Gashing of cutters is a compromise, governed, or at least affected, by:

1. Ability to heat-treat satisfactorily,
2. Ability to resharpen,
3. Chip space,
4. Expected number of regrinds.

Requirement 1 demands a good root fillet and progressive reduction of tooth section from the fillet radially outwards, and usually when it is satisfied Requirement 2 is also, for a good fillet permits the use of a reasonable-sized saucer wheel for sharpening. Requirements 3 and 4 are intimately connected with the material to be machined. For instance, to prevent chips packing in machining heat-treated duralumin, the chip space should be generous, and hence to obtain reasonable life of the cutter, the teeth must be of coarse pitch.

So long as the teeth are axial, no difficulty is encountered in properly gashing the cutters, but when the teeth are helicoidal, the shape of the gashing mill is of greater and greater importance as the lead of the gash diminishes.

Strictly, for all helicoidal gash milling, the cutter that generates the tooth face should sweep out some paraboloid or hyperboloid of revolution to be tangent to the tooth face helicoid. The analytical determination of the proportions of such cutters, while possible, is extremely complex, and its necessity may be dodged in a simple, practical way, as follows:

A pair of lead blanks are turned up to the approximate diameters of the cutter and grinding wheel intended to be used for gashing and sharpening respectively. A flycutter arbor is made and fitted with a drill rod cutter, the edge of which duplicates the position of the generatrix of the tooth-face helicoid. Obviously this may be either radial or raked at will, depending upon the material to be machined by the cutter when finished.

This arbor is mounted between centers on the universal milling machine, the dividing head is geared up to cut the gash lead, and the turned blanks are mounted on the cutter arbor. The flycutter is used as a turning tool from which the lead blanks are generate-turned. They will then have the swept form of a gashing cutter or grinding wheel which will, under proper conditions, produce the tooth-face helicoid.

Accurate record must be kept of center distance, angular relationships and offsets established at the time the lead blanks are turned, and these settings duplicated when using the gashing cutters or grinding wheels later on. Fig. 4 shows in diagrammatic form the set-up and dimensions to be recorded and duplicated.

The requisite lead of gash depends, from the cutting standpoint alone, upon width of cut, average depth, number of teeth and mean diameter of the cutter. The hand should be opposite to that of rotation when cutting, as a general rule, except when cutters are paired up.

If: r = average radius of cutter, and
d = average depth of cut,

Then $\arccos \dfrac{r-d}{r}$ = angle of wrap of work with respect to the cutter.

The axial extent of one cutting face in the cut at operating depth then approximately equals the product of gash lead times angle of wrap, divided by 360.

So for one tooth in full cutting contact at one time, the approximate gash lead is:

$$\text{Gash lead} = \frac{360 \text{ deg.} \times \text{width of cut}}{\arccos \dfrac{r-d}{r}} \quad \ldots\ldots (22)$$

and for two teeth in full cutting contact at one time, the approximate gash lead is:

$$\text{Gash lead} = \frac{180 \text{ deg.} \times \text{width of cut}}{\arccos \dfrac{r-d}{r}} \quad \ldots\ldots (23)$$

In the case of the slab mill, these are exact equations.

Choice of gash lead is influenced by characteristics of the work-piece to be milled and the machine it is to be milled upon, but really it is a fairly flexible quantity. Obviously change gears on the miller affect it, and it is usually just as well to make it some simple dimension, easily factorable both in numerator and denominator when put in the form of an improper fraction as will later be apparent. The shorter the gash lead, the more care must be exercised when sharpening the cutter.

The heel of the tooth presents no complexities other than can, if necessary, be cared for in a similar manner to those of the cutting faces.

Helically Gashed Form Cutters

Since the teeth are twisted, form cutters can be used only locally in such parts as sharply re-entrant corners on the profile to be produced.

Hence templets are substituted for form cutters. The templets are securely bracketed to the lathe bed, and a follower is mounted on the cross-slide to contact with them after the cross-feed nut has been disconnected. Contact is maintained by any of the usual spring or weight means.

Compensation for gash lead is obtained by modification of the relieving change gear rates as follows: When the feed helix and gash helicoid are of the same hand, relieving must occur progressively later in the cycle, until after the tool has been fed axially a distance equal to the

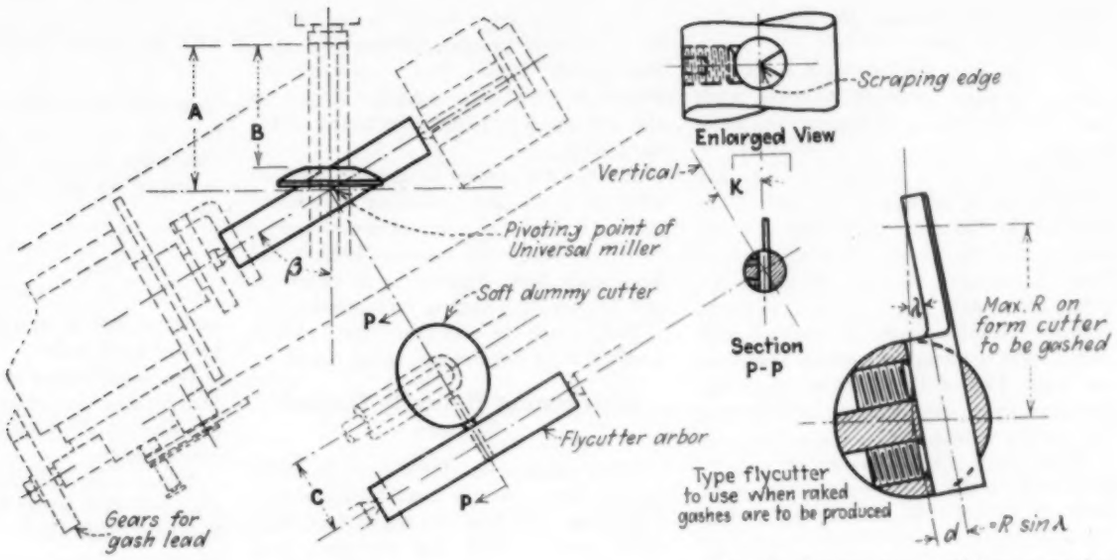


Fig. 4—Set-up for gashing may be determined by the use of a lead blank

Instructions:

1. Square table with spindle
2. Set scraper vertical over pivot point
3. Tilt scraper to angle K
4. Gear up for gash lead
5. Swing table to gash lead angle
6. Mount lead blank on arbor
7. Turn to shape
8. Record dimensions requested.

Notes: Record A, B, K and C when done. For tooth heel helicoid λ is negative. Scraper may be twisted in the bar since it then turns around its cutting edge. When developing the cutter for both sides of the gash, A, B, K and C may be adjusted for the first side, but A, B and C must be held constant when working out the second side.

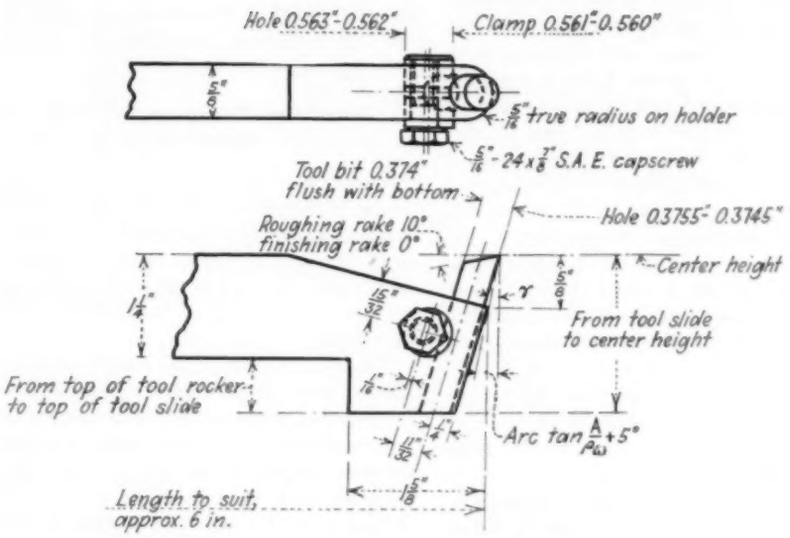

Hole 0.563"-0.562"
Clamp 0.561"-0.560"
5/16" true radius on holder
5/16"-24 x 7/8" S.A.E. capscrew
Tool bit 0.374" flush with bottom
Roughing rake 10°
finishing rake 0°
Hole 0.3755"-0.3745"
Center height
From tool slide to center height
From top of tool rocker to top of tool slide
Arc tan A/Pω +5°
Length to suit, approx. 6 in.

Fig. 5—Typical round-nose relieving tool for larger radii of curvature

gash lead, there has been omitted from the number of cycles that would obtain with axial gashes, a number equal to that of the helicoidal gashes.

The relieving gear ratio then becomes:

$$\frac{\text{Drivers}}{\text{Followers}} = \frac{N}{n} \times \frac{L}{L \pm f} \quad \ldots (24)$$

where: N = number of gashes
n = number of lobes on cam
L = lead of gash
f = feed per revolution of the workpiece.

The positive sign is used in the denominator when feed and gash helices are the same hand, the negative when opposite hand; longitudinal feed should be through the leadscrew to maintain proper phasing.

Feeding and indexing motions are thus interrelated, and change in feed involves recomputation of relieving gearing. Where several relieving cuts are needed, proper repetition of phasing may be had by marking the starting points of workpiece, slide and camshaft, the technique being identical with that employed in recutting helical gears on a gear hobber not equipped with a helix-compensating differential box. This is only necessary when the drive does not permit of reversing the lathe. When reversal is possible, the easier way is to advance or retard the workpiece by screws acting on the driving dog tail, or by advancing or dropping teeth in the relieving gear train, the extent determined by trial, the lathe reversed after trial, if necessary.

The relieving tool itself should be sharpenable without change of form. For profiles including small radii of curvature, the use of any commercial form ground single point Whitworth thread chasing tool or its equivalent is suggested, provided front clearance is satisfactory.

For larger radii of curvature a tool using circuler inserted toolbits, similar in type to that shown in Fig. 5, is suggested. With this type, front clearance is established with respect to the toolholder and need only be some 4 or 5 deg. more than the maximum clearance angle occurring on the cutter being relieved.

For roughing operations, the toolbit may have 10 to 15 deg. top rake with respect to the direction of cutting, but for finishing it should be set with zero rake and the whole top surface in the radial plane.

The radius of curvature of the nose of such a finishing tool is $\frac{d}{2} \sin \gamma$, and the ratio of major to minor axes of the elliptical cutting edge is cosec γ, where d is the diameter of the tool bit and γ the front clearance angle.

For γ up to 15 deg., the error introduced by using say a 3/8-in. diameter toolbit is usually negligible, when the follower contacting the templet is also 3/8-in. in diameter.

A templet of 1/4-in. cold-finished steel is usually sufficiently stiff. It may be cut out to approximate contour, set-up in the vertical miller and finished to coordinate dimensions of the profile, using a cutter fed endwise, machining step by step. The coordinate dimensions here apply to the axis of the end mill used, which end mill must be of the same

diameter as the follower pin and likewise of the toolbit used.

The resulting facet-formed surface is given a copper sulphate solution wash and drawfiled down to remove the little humps.

When raked helicoidal gashes are adopted, it is necessary to adjust the templet profile to compensate for the rake, using the values of Δx obtained from Equations 18 and 19 (Vol. 77, page 136), and for accurate work to comply with the gashing method, utilizing form generated cutters described on page 178 of this article, since departure from designed helicoidal face affects the relieving to some extent.

If the gash shape is wrong, it may be corrected in the sharpening as later described, but this is the expensive way to do it.

Characteristics of Cutter Blanks

When wide homemade form cutters are made, it is as well to substitute end cross-key drive for lengthwise keyseats in the bore. The average toolroom equipment both for slotting and for internal grinding of keyseated holes is not of the best, as these operations are of relative infrequency of occurrence. A long keyseated hole is mean to grind well even with the best equipment.

Provision of extending hubs for cross-key drive has the following advantages:

1. Place is provided for chucking for internally grinding the hole, and the whole cutter may be indicated by its outside, without interference occurring because of the chuck jaws. Thus the hole may be averaged with respect to the cutter shape after hardening.

2. The outside of the extended hub may be cleaned up and used for steady resting, in the case of a wide cutter, for the internal grinding operation. This is a good point with keyseated cutters as well.

3. The cutter often comes through the hardening process with less distortion when cross-key drive is adopted.

The disadvantages are:

1. More material is used in the cutter blank.

2. The finished cutter is less easily ganged up with others where a complete machining of profile and sides must be used at one pass.

Extent of Relieving

The workpiece should not be relieved to a sharp cutting edge for the following reasons:

1. When relieving with form tools, unless the lathe be exceptionally rigid, as the cut becomes heavier there is great tendency for the tool to dig and either spoil the work or make necessary a refinishing job.

2. A sharp edge tends to be lost in the hardening process, particularly with high-speed steel, and consequently affords less certain means for truing up the cutter for internal grinding after hardening.

If the workpiece is copper washed after gashing and relieving continued until a narrow band of copper about $\frac{1}{64}$ to $\frac{1}{32}$ in. wide still remains behind the final gash face, digging in is deterred, and truing for grinding facilitated.

Particularly is this true when radial-toothed form cutters are being made.

Sharpening Helically Gashed Cutters

Sharpening the faces of helically gashed form cutters consists merely in regenerate grinding the tooth face helicoids, and to this end the gash lead should be controlled either by leadscrew or by helical guides coaxial with the cutter being ground, and acting as both a lead and an index control member. The paraboloidal wheel shape, dressed and set to templet may be used.

Alternately, it is easy to visualize a generating diamond dresser, the diamond moving along the path of the tooth-face helicoid generatrix, progressively fed along this generatrix while being screwed past the grinding wheel to be trued. Such a dresser will obviously make the grinding wheel the proper shape, and substituting the cutter between centers for the dresser assures that the cutter tooth face helicoid will be accurately generated and the contour of the work reproduced.

Such a device, while not a commercial article, is patented in the United States, the patent being assigned to the Gleason Works.

In practice, its use is quite rapid and satisfactory.

Helicoidal Face Cams and Jaw Clutches

If helicoidal face cams and jaw clutches of moderate lift are to be made, they may, within stroke limitations of the cams available, be readily machined with the relieving attachment if it produces Archimedian spiral relief.

If a_c = cam constant
N = number of jaws
n = lobes on cam

Lead of the helicoid produced when the relieving slide is parallel to the work axis is:

$$L_h = \frac{2\pi N}{n} \times a_c \quad \ldots\ldots\ldots\ldots (25)$$

If no cam exists with a_c equal to or greater than $\frac{2\pi N}{nL_h}$ the part cannot be made by this method. If a cam exists with a_c greater than $\frac{2\pi N}{nL_h}$ and radial clearance sufficient exists between the face of the clutch and any hub, such cam may be used if the relieving slide be set at an angle μ with the work axis, where:

$$\mu = \arccos \frac{2\pi N}{nL_h a_c} \quad \ldots\ldots\ldots\ldots (26)$$

and the tool is straight line and normal to the work axis.

When such cams must nest or assemble face to face in surface contact, ability to produce Archimedian spiral relief is mandatory.

When hooked-faced jaw clutches are planned, care must be taken that time for retraction exists, i.e., that the ratio of approach to retraction times permitted by the design does not exceed that of the relieving cam, and that the pieces are gashed accordingly.

Notching Roughing Taper Reamers

Purchased commercial roughing taper reamers have usually straight flutes notched by chasing a thread of opposite hand to that of the reamer. Unfortunately this does not result in the entering corners of the teeth at the notches cutting freely.

Consequently they dull locally at these points, with poor results ensuing. For free cutting, they should have some 2 to 4-deg. axial clearance, and when so made consume less power and last longer. The relieving cam used must be capable of cutting a lead equal to the sum of the notch lead plus a lead giving the requisite axial clearance at the large end of the reamer. This axial clearance will then increase toward the smaller diameter. The attachment is generally set so that the slide movement parallels the work axis, and the taper attachment is used in addition.

If: γ_a = desired clearance angle (axial)
N = number of flutes in reamer
n = number of lobes in cam
L_n = lead of notch helix
D = large diameter of reamer
a_c = cam constant necessary

Then:

$$a_c = \frac{n\,(\pi D \tan \gamma_a + L_n)}{2\pi N} \quad \ldots\ldots (27)$$

or alternately, with a_c maximum and $n = 1$, the maximum lead of the notch helix is:

$$L_n\,(\text{max.}) = 2\pi N a_c - \pi D \tan \gamma_a \quad \ldots\ldots (28)$$

With adjustable stroke relieving attachments, this result is approximated by setting the stroke to the value:

$$S \simeq \frac{L_n + \pi D \tan \gamma_a}{N} \quad \ldots\ldots\ldots (29)$$

EDITORIALS

AMERICAN MACHINIST
VOLUME 77 ESTABLISHED 1877 NUMBER 6
McGRAW-HILL PUBLISHING COMPANY, INC.
K. H. CONDIT F. H. COLVIN
EDITORS

History Repeats

John A. Hill, owner and publisher of *American Machinist* in 1907, took the editorial page of his issue of December 5 in that year and exhorted his readers thus:

"There are some financial troubles of one kind or another worrying the most of us.

"Stop worrying.

"All of this so-called panic is caused by wrongdoing. None of it is caused by reason of 'the conditions.' In 1893 there were plenty of reasons for the panic—the crop failures alone being reason enough. Not one of these conditions obtains today.

"The money trouble comes as the culmination of several disturbing factors.

* * * *

"All of these came to a head at once, producing a scare, and the bankers fell down—the worst scared of the lot. Currency was withdrawn from circulation and hidden—and the bankers hid most of it. Then there was the putting of currency on a fiat basis—clearing-house checks are no more money than beer checks or store orders.

"There are thousands of reasons and opinions as to what brought it all about.

"What difference does it make now?

"What can we do to get back where we were? That is the question that confronts the business man and the manufacturer.

"We have seen some circular letters from banks and trust companies asking for deposits and stating that the institutions in question had in their vaults much more currency than that required by law—this to give the prospective depositor confidence.

"It is the one thing that ought to destroy his confidence in that bank.

"The reserves are for just such emergencies. Accumulating beyond the requirements is the worst form of hoarding money.

"Others hoard because they are ignorant, the banker should know.

* * * *

"Stop talking panic. When such troubles come, brave men take to their work, cowards to the brush.

"Strain every effort to keep your shop going—don't throw out of work the men whose suffering will make the times harder.

"Don't hold up your bills if you can pay—it makes someone else do the same.

"Don't countermand orders—it is catching. And don't accept countermands from solvent institutions where you have the materials bought and the work in hand.

"Accept delay delivery, longer time if need be, but no countermand. You have some rights in the matter, assert them.

* * * *

"Hidden money earns nothing and is unsafe; coax it back into circulation. There is enough if it were available.

"A thousand dollars turned loose Monday morning will have paid obligations of a hundred thousand before Saturday night and relieved many a firm's immediate necessities.

"Let's stop trying to locate the cause.

"Let's stop trying to devise a more elastic currency—Congress will do that.

"Let's try as individuals to help the matter in our own little way in our own little field. You can influence someone with money to buy securities or put his money back in the bank. Do it."

* * * *

Today many of us feel that our troubles are absolutely unprecedented, that no one has ever had such a tough time as we are having. Yet the causes of current ailments are much like the causes of the ills of 1907, and of other crises in our economic life. We found a way to cure them then; we shall find a way to cure them now.

If we are not vastly mistaken the new administration has a solution for our financial worries that will be a better one than was evolved in 1907, and the new Congress will show unexampled speed in getting the enabling legislation on the statute books.

This is a crisis, but we agree with Walter Lippmann that it is a good crisis—that it marks the turning point in the cycle and that its results will be beneficial. Let us all take to heart John Hill's words of a generation ago. No one of us can settle the affairs of the nation. Franklin D. Roosevelt has that responsibility, but all of us can do something to help matters "in our own little way in our own little field." We did it before and we can do it again.

Inch-Millimeter Conversion for Industrial Use

It seems that the recent editorial entitled "The New Inch-Millimeter Ratio" has been taken by some to mean that the Bureau of Standards has changed the legal ratio between the inch and the millimeter. This is not the case. No change whatever has been made

in the *legal* ratio. American industry has simply decided to use, in making its own measurements, the flat ratio 25.4, thus unifying its practice with that of British industry which made the same decision in 1930.

Actually, this practice has been followed by American industry for many years. The difference of two parts in one million between the legal and the new "industrial" ratio is too small to be taken into account in production work, and even in gage work unless the gages are of the highest known degree of precision. The adoption of the ratio 25.4 as an American *industrial* standard was brought about through the procedure of the American Standards Association, with full cooperation of the Bureau of Standards. However, the Bureau could not change the legal ratio. This could be done only by legislation.

A Sign of Improvement

A road service man of one of the big machine tool companies reports that some of the shops he visits have had trouble when they started up machine tools that had been idle for a long time. The remedy for such trouble is simple and obvious—wash out all old or gummy lubricant and replace with fresh oil. But that is not the significant point about the report. What matters is that jobs have come in to interrupt the long rest of these machines and their operators. We look upon it as a sign of improvement and we are correspondingly encouraged.

• CHIPS •

Roosevelt inaugurated as banks of nation close . . . moves swiftly to get situation under control by assuming dictatorial powers under the terms of a war measure that has never been repealed . . . declares banking holiday and calls Congress into immediate session . . . Congress ratifies steps taken to protect banks and grants President sweeping power to embargo gold, control the currency and liquidate weak banks . . . also gives him power to slash expenses, including veterans' payments, cut salaries and reorganize bureaus and departments . . . Proposal to issue nationally valid clearing house certificates is abandoned in favor of issuing Federal Reserve notes.

Federal Reserve banks authorized to lend money to corporations and individuals on collateral consisting of U. S. obligations . . . also to lend on sound bank assets . . . Steps to force return hoarded gold and gold notes scares some hoaders into returning considerable sums . . . Roosevelt, on nation-wide radio hook-up, explains cause of bank moratorium and steps taken to save situation . . . 12 Federal Reserve Banks and banks in their cities open first, then banks in 250 clearing-house cities, finally other banks certified as sound . . . State banks reopen under local regulations . . . Many banks, too weak to open, will be saved by reorganization under government direction . . . Scrip is issued in several communities to tide over the emergency . . . Exchanges close and goods prices fluctuate.

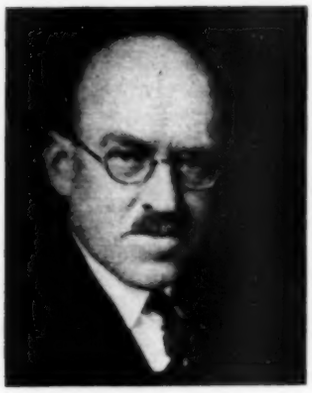
National City Bank of New York moves to divorce its securities affiliate, the National City Company . . . Aldrich, new president of Chase Bank, New York, issues statement calling for separation of banking functions more drastic than that contained in Glass bill . . . Far reaching reconstruction of the banking structure is generally expected . . . If it does not come promptly the good done by the temporary measures may turn bad very quickly.

Business finds ways to get along without banks . . . Railroads accept checks, restaurants and theatres take I.O.U.'s . . . New Haven cancels crack trains because of no passengers . . . Macy's has biggest day in two years as patrons with deposit accounts turn them into goods . . . Automobile companies open own banking offices to cash pay checks . . . Telephone and telegraph business jumps . . . Some companies pay employees in grocery orders . . . Dayton uses aluminum coins, Dow Chemical Company pays its people in Dowmetal tokens, redeemable later . . . . Chevrolet, Buick, Continental and other big Michigan plants shut down . . . smaller plants forced to follow by suspension of parts orders.

Chevrolet announces its new, cheaper, standard six, almost as large as the other six but stripped of gadgets . . . Ford takes his time with the smaller V-eight . . . Chrysler omits dividend . . . American Sheet & Tin Plate advances prices of sheet $1 to $3 per ton . . . Steel production falls off . . . Electric power production falls a little further behind 1932 record but still keeps fairly close . . . Puddlers' wage scale raised on strength of product price increase . . . Wheat, cotton and metal prices rise in anticipation of at least some inflation.

European countries watch financial situation here closely . . . Gold countries fear for their currency if U. S. leaves gold . . . England apprehensive of foreign trade advantage if dollar drops in foreign exchange . . . Unofficial quotations show small drop . . . Hitler wins German election and strikes for police control of states . . . arouses French fears and Italian enthusiasm . . . Japan overflows Jehol and breaches great wall of China . . . sets up large war budget . . . Soviets look hopefully to new administration for recognition.

JAMES HARTNESS



RALPH E. FLANDERS

HENRY S. BEAL

Flanders Heads Jones & Lamson

RALPH E. FLANDERS has been elected to the presidency of the Jones & Lamson Machine Co. in place of JAMES HARTNESS who recently retired. K. H. WOOLSON was made vice-president in addition to his former office of treasurer.

Mr. Flanders started his busines career as an apprentice with the Brown & Sharpe Mfg. Co. in January, 1897, and continued with that concern until 1902 when he went into the drafting room of the Taft-Peirce Co. He was then successively associated with Flather & Co., the International Paper Box Co., and the West Lynn Works of the General Electric Co. In 1905 he became associate editor of *Machinery* and in 1910 sales engineer for the Fellows Gear Shaper Co. Two years later he went with Jones & Lamson as manager of the Fay Automatic department and early in 1914 was made general manager. Later he became vice-president of the same concern. Mr. Flanders is a past president of the National Machine Tool Builders' Association, a past vice-president of the A.S.M.E., a member of the National Screw Thread Commission and has held many other offices of distinction. He is also author of "Taming Our Machines."

Mr. Hartness was born in Schenectady in 1861. He became associated with Jones & Lamson in 1888 first as superintendent, then as manager. He has been president for 32 years. Among his many inventions is that of the flat turret lathe. In 1910, the University of Vermont conferred upon him the honorary degree of M.E., and in 1913, Yale University gave him an honorary M.A. Mr. Hartness is a past president of the A.S.M.E., a fellow of the American Association for the Advancement of Science and a fellow of the Royal Astronomical Society. He is a member of many other clubs and societies and has served with distinction in many capacities, public and private.

Beal Becomes President of Sullivan Machinery

HENRY S. BEAL, formerly general manager of the Jones & Lamson Machine Co. and president of the National Machine Tool Builders' Association, has been elected president of the Sullivan Machinery Co. Mr. Beal is a graduate of Dartmouth and also studied at the University of Berlin. In 1909, he become associated with Jones & Lamson and was successively machinist, traveling demonstrator, cost accountant, sales manager, assistant general manager and general manager.

Mr. Beal succeeds ARTHUR E. BLACKWOOD who has served as president of the Sullivan Machinery Co. since 1928. Mr. Blackwood, who now becomes chairman of the board of the same concern, has been associated with the company since 1897 when he entered its service as manager of the New York office. In 1919 he went to Chicago to assume the duties of vice-president in charge of finance and was elected president on the death of Frederick K. Copeland.

INDUSTRIAL REVIEW

Already at an abnormally low point, machinery business came to a general standstill as a result of the state and national bank holidays. The trade is not looking for any improvement until the financial situation clears up, although it is admitted that the tentatively higher prices of scrap and metals are encouraging. There is a general tendency to recognize the need for a surgical operation on the banking and monetary structure and a readiness to stand behind the administration in the hope that the operation will be successful.

Detroit, first to feel the brunt of the blow, reports the closing of such key plants as Chevrolet, Buick, and Continental. The smaller plants, which have been fairly active, have had to curtail because their customers have held up orders. In Cleveland there is little hope of a resumption of business until interstate banking is restored. Local committees are endeavoring to insure food supplies and continuation of essential services. The Cincinnati banks did everything possible to take care of payrolls. Metal-working plants are practically closed and there have been reports of a few cancellations.

From St. Louis comes word of the cheerful acceptance of hard conditions and a faith in the President. Banks are cashing 20 per cent of payroll checks. Chicago business ceased with the moratorium but sentiment is more hopeful than it has been. There is a similar absence of business in Milwaukee, no one has received any orders.

Pittsburgh also reports a feeling of confidence in President Roosevelt. Although what prospective business there was is now in abeyance salesmen are doing the missionary work that is possible under the circumstances. Philadelphia reports some Navy Yard business but nothing else of interest. New York shared in this business but otherwise is quiet. Boston reports keen disappointment because of the suffocation of promising developments that were expected to produce some orders.

Case Conference Postponed

Because of the bank holiday and general unsettlement of business, the conference on "Re-Engineering for Economical Manufacture" scheduled to be held at the Case School of Applied Science, March 22, 23 and 24, has been postponed indefinitely. The conference, which was recently announced in these pages (*AM*—Vol. 77, page 148e), may be held with substantially the same program when conditions become more stable.

A.S.A. Committees Appointed

Committees of the American Standards Association for 1933, which were recently announced, will function under the following chairmen:

Finance—BANCROFT GHERARDI, vice-president, the American Telephone and Telegraph Co.

Ways and Means—F. E. MOSKOVICS, Frederick H. Levy Co.

Representation—W. T. ROSSELL, vice-president, Brooklyn and Queens Transit Corporation.

Procedure and Administration Problems—ALEXANDER MAXWELL, Edison Electric Institute.

Rehabilitation Move Makes Further Progress

With total expenditures of $165,392,772 planned for new projects, the National Committee on Industrial Rehabilitation reports a gain of more than $10,000,000 over its last previous figure. Some of the metal-working concerns, not previously reported, whose commitments have gone to make up this total, are given below. President Roosevelt has expressed his approval of the activities of the committee.

Markem Machine Co., new milling machine and tools, $2,000; American Locomotive Co., miscellaneous improvements, $10,000; McIntosh-Seymour Corporation, modernization of power house, $114,000; The Pfaudler Co., $150,000; Gleason Works, $80,000; Ritter Dental Mfg. Co., $10,000; Galusha Stove Co., $10,000; American Laundry Machine Co., $16,000; Stromberg Carlson Mfg. Co., $53,892; Delco Appliance Co., $25,000; Gould Pumps, Inc., alterations and new machinery, $8,700; Westinghouse Air Brake Co., complete rehabilitation, $50,000; Ahlberg Bearing Co., replacement and modernization, $16,000; Illinois Steel Co., $100,000; Railway Steel Spring Co., power house rehabilitation, $80,000; Champion Machinery Co., $3,065; Illinois Wire & Mfg. Co., $2,800; Mattson Wire & Mfg. Co., $2,500; Iowa Malleable Iron Co., replacing equipment, $3,000; Sivyer Steel Casting Co., new equipment, $25,000; Sterling Wheelbarrow Co., new equipment, $15,000; W. A. Jones Foundry and Machine Co., capital expenditures, $5,000; The Cable Co., plant repairs, $10,000; Electric Household Utilities, plant improvements, $30,000; Grigsby-Grunow Co., new machines, $22,000; National Machine Works, plant rehabilitation, $6,500; The Whiting Corporation, boiler room improvements, $10,000; Union Steel Products Co., repairs to building and equipment, $10,000; Defoe Boat & Motor Works, modernization, $15,000; American Blower Corporation, building and machine repairs, $16,600; Detroit Plating Industries, repairs, $1,000; Michigan Seamless Tube Co., rehabilitation, $40,000; Murchey Machine & Tool Co., new equipment, $10,000; Wolverine Tube Co., $10,000; The Murray Corporation, new equipment and construction, $120,000; American Enameled Wire Co., new equipment, $10,000; Bendix Aviation Corporation, plant improvements, $50,000; Alvey Conveyor Co., machine tools, $8,000; Champ Spring Co., modernization, $17,500; St. Louis Lamp Works, new equipment, $60,000; Continental Can Co., replacing machinery, $4,000; Westcott Valve Co., $3,500; Stove Mfg. Co., replacing furnace and building, $36,000; Southern Malleable Iron Co., rehabilitation, $9,240; Eagle Foundry Co., equipment, $10,000; Orbon Stove Co., equipment, $2,500; Peerless Enamel Products Co., repairs and additions, $6,000; Consolidated Steel Corporation, $10,000; Kinney Iron Works, new equipment, $2,500; Pacific Pump Works, rebuilding testing department, $8,000.

Weston Awarded Lamme Medal

"For his achievements in the development of electrical apparatus, especially in connection with precision measuring instruments," Dr. Edward Weston was awarded the 1932 Lamme Medal of the American Institute of Electrical Engineers. Presentation will be made at the summer convention to be held in Chicago June 26-30. Dr. Weston, founder and now chairman of the board of the Weston Electrical Instrument Corporation, has devoted his life to the development of electrical apparatus, processes and instruments. He is the recipient of many honorary degrees and other recognition of his accomplishments.

A.S.M.E. Editor Dies

CHARLES MACCAUGHEY SAMES, associate editor of the American Society of Mechanical Engineers since 1916, died suddenly on March 9. Born at Rockford, Ill., in 1866, he graduated from the Rose Polytechnic Institute with a B.S. degree in 1886.

After a year with the Thomson-Houston Electric Co., Mr. Sames joined his father in the manufacture of agricultural instruments. In 1900 he started his editorial career and first compiled the *Pocket Book of Mechanical Engineering*. In 1906, he was book editor of the Engineering News Publishing Co.

From 1907 to 1913 he was associate editor of *Technical Literature, The Engineering Digest* and *Industrial Engineering*. For three years following he assisted Professor Lionel S. Marks of Harvard in preparing the *Mechanical Engineers' Handbook*.

Industrial Pension Plans Need Revision

According to a report, "Industrial Pension Systems in the United States and Canada," by Industrial Relations Counselors, radical revision of industrial pension plans is necessary if the movement is to survive as a voluntary function. The study, made by Murray W. Latimer, indicates that the great majority of pension plans now in operation are legally and financially insecure. Nearly one third of the plans have been either discontinued or revised downward.

One in every seven persons engaged in industry or about 4,000,000 in all are affected by pension plans which involve an outlay of $100,000,000 annually. An underlying cause of failure is lack of foresight in appraising the financial obligations incurred and misconception as to the true nature of pensions. The difficulties encountered are said to be caused by the circumstance that "voluntary provisions of complete old-age security by industry, under a business economy in which a criterion of success and the condition of continued existence is profits, inevitably involves unescapable contradictions."

It was found that pension plans failed industry at the time they were most needed largely because of unsound financing and disregard of actuarial considerations. Forty plans or almost 10 per cent of those in force were wholly or partially discontinued between 1929 and 1932. In addition 61 others, normally covering 1,100,000 employees, were deliberalized and large numbers of pensioners suffered reduction in payments.

A.S.A. Shows Progress in Mechanical Projects

With the exception of safety code standards, all mechanical engineering projects under the procedure of the American Standards Association are summarized below. The status of each as of January 1, 1933 is briefly given.

B 1—Screw Threads. Revision of American Standard for screw threads for bolts, machine screws, nuts and commercially tapped holes (B1a-1924) has been practically completed.

B 2—Pipe Thread. Rearrangement of data for American Standard pipe threads (B2-1919) completed by the subcommittee; to be submitted to industry.

B 3—Ball and Roller Bearings. Revisions (B3.1-1933) approved by A.S.A. Taper roller bearing, adapter-sleeve bearing and angular contact bearing standards under consideration.

B 4—Allowances and Tolerances for Cylindrical Parts and Limit Gages. Committee appointed.

B 5—Small Tools and Machine Elements. Committee 1. T-slots. Increase in height tentatively adopted in December 1932 applying to B5a-1927.

Committee 2—Toolholder Shanks and Toolpost Openings. No revision in B 5b—1929 considered.

Committee 3—Machine Tapers. Further action on "slow" tapers to be taken in April.

Committee 4—Spindle Noses and Collets for Machine Tools. Proposed American standard adopted by turret and automatic lathe groups of the N. M. T. B. A.

Committee 5—Milling Cutters. Standard (B5c-1930) approved by A.S.A. in 1930.

Committee 6—Designation and Working Ranges for Machine Tools. No progress.

Committee 7—Twist Drill Sizes. Action postponed until the spring 1933.

Committee 8—Drill Jig Bushings—Proposed standard published for comment last November.

Committee 9—Punch and Die Holders. Comments considered at December 1932 meeting.

Committee 10—Circular Forming Tools. Revised proposal sent out November 1932. December meeting decided to cover tools other than circular.

Committee 11—Clutches and Clutch Jaws. Standard on rotating air cylinders (B5-5-1932), approved by A.S.A. last September. Awaiting further action of Committee 4.

Committee 12—Cut and Ground Thread Taps. Questionnaire on thread length of hand taps now being analyzed. Standard B5e-1930 to be supplemented for special purpose taps.

Committee 13—Splines and Splined Shafts. Marking time awaiting developments on involute splines.

Committee 14—Electric Welding Dies and Electrode Holders. Recommendations expected in spring of 1933.

Committee 15—Milling Machine Tables. Proposal on slot spacing expected soon.

Committee 16—Rotating Tool Shanks. First meeting in April 1932 appointed three subgroups.

Committee 17—Nomenclature. December 1932 meeting defined the task as review and unification of nomenclature of tools and machine tool elements.

Committee 18—Drill Head Spindles and Bearings. Manufacturers consider standardization of over-all dimensions impractical at present. Something may be done with spindle connections and drill holders.

B 6—Standardization of Gears. Spur gear tooth form (B6. 1—1932) approved by A.S.A. Proposed practice on gear materials approved by sectional committee. Subcommittee at work on gear inspection.

B 16—Pipe Flanges and Fittings. Revision on steel flanges B16e—1932 aproved by the A.S.A. Sectional committee approved standard—on pipe plugs. Other projects making progress.

B 17—Standardization of Shafting. Revision of four standards are nearing completion.

B 18—Bolt, Nut and Rivet Proportions. Approval of dimensions on wrench-head bolts and nuts and wrench openings now under consideration. Draft for socket-type screws will soon be published for comment.

B 26—1925—Screw Threads for Fire Hose Couplings. No change.

B 27—Plain and Lock Washers. Proposed tentative standard on lock washers under revision.

B 29—Transmission Chains and Sprockets. Roller chains, sprockets and cutters approved in 1930. No progress in silent chains.

B 31—Code for Pressure Piping. Several sections have been reviewed by the editorial committee. Section on gas and air piping to be completed shortly.

B 32—Wire and Sheet Metal Gages. No progress.

B 33—Hose-Coupling Screw Threads. (Nominal sizes ¼ to 2 in. inclusive). Submitted to members of sectional committee.

B 36—Standardization of Dimensions and Material of Wrought-Iron and Wrought-Steel Piping and Tubing. Tentative standard for pipe for service at 450 deg. F. max. soon to be published.

B 38—Standards and Specifications for Refrigerators. Code for testing ice refrigerators (B38c 1-1931) completed. Code for mechanical refrigeration a stalemate.

B 40—Pressure and Vacuum Gages. Report on definitions, specifications and installation expected soon. Questionnaire on gage sizes and mounting dimensions sent out in January. Agreement reach by subcommittee on accuracy and test methods.

B 41—Stock Sizes, Shapes and Lengths of Iron and Steel Bars. No definite proposals as yet.

B 42—Leather Belting. Draft on specifications now being prepared. Proposal on selection, care and installation expected at an early date.

B 43—Dimensions of Machine Pins. No progress since publication of proposed standard in 1930.

B 44—Industrial Thermometers. No progress.

B 45—Foundry Equipment. Progress reported by Subcommittee 1. Standard color markings for patterns approved by A.S.A.

B 46—Classification and Designation of Surfaces According to Quality of Surface. Committee met December 1932 and appointed five subcommittees.

B 47—Plain and Thread Plug and Ring Gage Blanks. Approved by A.S.A. as American Standard B 47—1932. Additional recommendations under way.

B 48—Inch-Millimeter Conversion for Industrial Use. Proposed standard sent to industry for comment.

B 49—Shaft Couplings, Integrally Forged Flange Type for Hydro-Electric Units. Standard (B 49—1932) approved by the A.S.A.

State College Announces Short Management Course

Dean R. L. Sackett, of the Pennsylvania State College, has announced that June 7 to 15 inclusive are the dates selected for the eighteenth summer management course. Among the topics of study is a discussion of current economic problems.

Meeting three times a day in an informal manner, the classes give industrial executives and supervisors a wealth of practical ideas and suggestions to carry back to their plants. Other subjects to be studied are industrial organization; principles, methods and application of production control; trends in personnel management; principles of operation study; economic control of quality; methods of industrial training; causes of budget failures, factory layout, and the development of executive ability.

•BUSINESS ITEMS•

General offices of the Doehler Die Casting Co. will be moved from New York to Toledo, Ohio, the site of the company's largest manufacturing plant, according to a decision of the board of directors. An eastern sales office will be maintained at New York under the direction of L. H. PILLION, vice-president in charge of sales. Contrary to previous reports, the company's Brass Division will be maintained at Batavia, N. Y., and manufacturing operations will be continued at the Pottstown, Pa., plant as heretofore.

The Kingsbury Machine Tool Corp., Keene, N. H., manufacturer of high production, automatic drilling and tapping machines, has appointed the Riordan Machinery Co., 213 Curtis Bldg., Detroit, as its exclusive representative in the Detroit district.

Metallizing Co. of America, Los Angeles, Calif., specializing in sprayed metal coatings, has opened an eastern sales office at 214 Provost St., Jersey City, N. J., in charge of R. A. AXLINE. Demonstrations and technical information will be furnished. At the same address will be located the International Metallizing Association, and L. E. KUNKLER, president of the above company, will devote his attention to the association on a part-time basis. An export office of the company will be maintained at 15 Moore St., New York City, under direction of J. GLOSNER.

Callahan Can Machine Co., Inc., organized by T. E. CALLAHAN and JAMES B. ROHDE, on Dec. 31, 1932 acquired the assets, including trade marks, trade names and good will, of the Adriance Machine Works, Inc., Brooklyn, N. Y. The latter company had been in receivership. It manufactured a line of presses, dies, machinery for working sheet metal, automatic can machinery, machinery for making crown caps, as well as special machinery. The new corporation will continue the manu-

facture of the machines listed above and will carry in stock repair parts for Adriance machines now in use.

The Barber-Colman Co., Rockford, Ill., has made changes in its New England and Chicago sales offices. To maintain direct factory representation in New England, F. R. RIDGLEY will have an office with the Barber-Colman Co. of Massachusetts at Framingham. In Chicago the office of the machine and small tool division will be merged with that of the electrical division and will be located at Suite 718, LaSalle-Wacker. Bldg., 221 N. LaSalle St. CLINTON S. MOREY will be the representative.

E. F. Houghton & Co., with plants in Philadelphia, Chicago and Detroit, announce that they will manufacture and sell the products formerly made by Weaver Bros. Co., Cleveland, Ohio. J. C. WEAVER, formerly vice-president of the latter company, is now manager of the cleaner and pickling products department of E. F. Houghton & Co. Weaver Bros. made products used in pickling of metals.

The Independent Air Filter Co. has moved to larger quarters at 215 West Ohio St., Chicago, Ill. Double the floor area will be available for manufacturing and other purposes.

Triplex Machine Tool Corp., formerly located at 50 Church St., New York, N. Y., has moved to larger quarters in the World Telegram Bldg., at 125 Barclay St. and corner of West St. The larger quarters will afford space for a show room.

Management of Nye Tool & Machine Works, Chicago, will be continued by those identified with the late HARRY G. NYE, president. O. S. LEE will continue as general manager. Associated with him will be HARRY G. NYE, JR., and W. J. GREDE.

A majority of the board of directors of the DeVlieg Machine Tool Co., Jackson, Mich., applied to the Circuit Court for dissolution of the corporation. A decision will be rendered on Mar. 29. ROY T. KAYWOOD, of Jackson, has been appointed temporary receiver.

The New Jersey Gear & Mfg. Co. has been incorporated in New Jersey with a capitalization of $125,000. The company is located at Newark, N. J. Incorporators are ANTHONY FAILLA, ANTON WELLIN and HELEN SOBEL.

The plant of P. H. Fitzgibbons Boiler Co., Ogdensburg, N. Y., was destroyed by fire with a loss of $6,000. Plans for rebuilding are reported to be under consideration.

• PERSONALS •

CHARLES A. MORROW, vice-president of the Youngstown Pressed Steel Co., has been given complete charge of the plant, according to an announcement of HENRY A. ROEMER, president of the Sharon Hoop Co., the parent organization.

WILLIAM R. DIESEL has succeeded the late WILLIAM R. HILL as president of Sargent & Greenleaf, Inc., lock manufacturer, Rochester, N. Y. Mr. Diesel has been connected with the company for more than 30 years and is known as an authority on time and combination locks.

ALTON FARREL, treasurer and a director of Farrel-Birmingham Co., Ansonia, Conn., has resigned because of ill health. He has been succeeded by FREDERICK M. DREW, JR.

CHARLES J. HARDY, general counsel for the American Car & Foundry Co., New York, has been elected president, succeeding WILLIAM H. WOODIN, new Secretary of the Treasury.

W. C. HORR has succeeded the late W. C. BECKWITH as president of the Byers Machine Co., Ravenna, Ohio.

W. H. MCCLELLAND, a director and for 15 years sales manager of the machinery department, Strong, Carlisle & Hammond Co., Cleveland, has resigned. Successor is G. J. ZIMMERMAN, formerly in charge of the used machinery department and supervisor of the Detroit office.

C. MARSHALL TAYLOR has been made manager of the New Products Division of G. M. Basford Co., New York, an advertising agency. Mr. Taylor was formerly vice-president and general manager of Curtin-Howe Corp., timber preservation engineers.

EDGAR WILSON, a production engineer of Milwaukee, has been appointed factory manager, Highway Trailer Co., Edgerton, Wis., at the Stoughton, Wis., plant. Mr. Wilson succeeds JAMES HIGGINS.

• OBITUARIES •

FRANK HORSBURGH, founder and president of Horsburgh & Scott Co., gear manufacturer, Cleveland, Ohio, died Mar. 4 at the age of 78. In 1888 Mr. Horsburgh entered into a partnership with THOMAS SCOTT to do business as general millwrights and machinists. With the introduction of electric street cars the business specialized in the manufacture of gears. Later Mr. Horsburgh bought Mr. Scott's interest and formed the present Horsburgh & Scott Co. He was one of the founders of the American Gear Manufacturers' Association and acted as its treasurer for several years.

CLAUDE B. BAILEY, 54, general manager of the Wyandotte, Mich., plant of the McCord Radiator Co., for the past 18 years, died recently.

SCOTT E. GILMORE, 42, production manager of Colson Co., manufacturer of juvenile's vehicles, for the past 12 years, and formerly connected with Warner & Swasey Co., Cleveland, died at Elyria, Ohio.

WILLIAM C. KELLY, founder of the Kelly Ax & Tool Co., now a division of the American Fork & Hoe Co., and also founder and president of American Barge Line, died Mar. 2.

JOHN MCGEORGE, founder of the Electric Controller & Mfg. Co., and recently chief engineer of Ernest McGeorge, Inc., Cleveland, died recently.

• MEETINGS •

AMERICAN GEAR MANUFACTURERS ASSOCIATION. Annual meeting, May 4-6. Penn Lincoln Hotel, Wilkinsburg, Pa. J. S. MCQUISTON, managing secretary, First National Bank Bldg., Wilkinsburg, Pa.

AMERICAN MANAGEMENT ASSOCIATION. Division meetings—job order production and mass production. April 13-14. Hotel Statler, Cleveland, Ohio. K. B. ANDERSEN, secretary, 20 Vesey St., New York, N. Y.

AMERICAN SUPPLY & MACHINERY MANUFACTURERS ASSOCIATION. Annual meeting. May 8-11. Louisville, Ky. R. KENNEDY HANSON, secretary-manager, Clark Bldg., Pittsburgh, Pa.

AMERICAN WELDING SOCIETY. Annual meeting. April 27-28. New York, N. Y. MISS M. M. KELLY, secretary, 29 West 39th St., New York, N. Y.

GRAY IRON INSTITUTE. Annual meeting. March 22. Hotel Cleveland, Cleveland, Ohio. ARTHUR J. TUSCANY, manager, 4800 Euclid Ave., Cleveland, Ohio.

NATIONAL FOREIGN TRADE COUNCIL. Twentieth national foreign trade convention. April 26-28. Hotel William Penn, Pittsburgh, Pa. GARDNER L. HARDING, secretary, India House, Hanover Square, New York, N. Y.

High Finance

"Say, Ed, how'd you like to become a stockholder in our compressor company?"

"What do you mean by that, Al? I know you too well to believe you are trying to do your friends."

"Just what I say. If Mason and I decide to incorporate, do you want to buy a few shares of stock?"

"Oho! so you're going to follow my advice and incorporate."

"We are thinking of it. Mason and I were talking matters over last evening and sort of outlining our future policies. Heretofore, we have been operating from hand to mouth, so near the brink of failure that it would have taken mighty little to shove us over. While we were in that state, we did not want to involve our friends. We now consider that phase of our troubles as past and are looking toward the future with confidence."

"Maybe so, Al. But as I told you last time at lunch, I think the bigger shop is a mistake, and that your feeling of confidence is merely enthusiasm begotten of improved working conditions and not improved business conditions."

"Mason and I aren't fooling ourselves. Conditions are better. Dealers are beginning to come to us for agencies. We figure that we should get orders for one thousand compressors from breweries alone during the next year. We've just tied up with three men, one in the East, one in the Middle West and one on the West Coast to handle this trade. And we want to do something for the friends that have helped us out."

"Mighty fine of you, Al; just what have you in mind?"

"Well, our book value at the present time is about $10,000. Our good will value is worth about the same. We figured that we would incorporate for $20,000, each keep $5,000 worth of the new stock as our share, put $5,000 of it in the treasury, and sell the remaining $5,000 to our friends."

"At what price?"

"At par, of course."

"I could buy stock in some mighty big companies right now if I had the money —and at less than par."

"Well, this is a mighty small company, and anybody that wants stock has to pay par for it. It gives you the opportunity to acquire a substantial block of stock in what will eventually be a big company, at little expense and no risk. If you say so, we'll set aside ten shares of stock for you to be paid for at your convenience. That will be five per cent of our capital stock."

"Maybe it's all right, Al, but the way times are I don't feel that I can risk it. Thanks just the same."

"Don't be foolish, Ed. In the back of your mind you think that if Mason and I really wanted to benefit our friends we'd give them some stock outright. You figure that the stock costs us nothing so it's rather an imposition to sell it to our friends at par. Well, you're wrong. Mason and I will have paid par for every share we get. There is no risk whatever to our friends because we will bind ourselves to buy the stock back at any time before it's paid up. We'll charge interest for deferred payments, but the stock interest will more than carry the charges. We're selling Williams twenty shares. He wants fifty. What say, Ed?"

Would Ed be wise to invest in such a new enterprise? Could Al make good his promise to buy back the stock if the firm got into real difficulties?

Discussion

Larger Quarters

It takes unusual ability, even when one has capital, to keep it productively yet safely employed. The business highway is strewn with the wrecks of those who overexpand. The enterprise that starts off with three cheers and a nice amount of capital too often slows down and finally comes limping back from the fray. But it is just as true that the ultra-conservative camp harbors most of the industrial weaklings. The only possible moral to be drawn from these facts is that there is a middle course somewhere, which it is best to pursue in each individual case. Let us hope Al finds it.

If Al has actual orders in the sack that will warrant his moving into the factory he has in view, well and good. But let him not go too far on the opinion of engineers who have tested the new model and found it good. Proving a thing good is one thing; selling it is another. Some things do not "take" in the market, regardless of how good they may be.

The small plant has undeniable advantages in strenuous times. But size, or lack of it, are not often factors which make or break a firm. The real making and breaking factor is management—the simple science of using horse sense in the various and daily problems which

come to the manufacturer. If this science be a constant, the variables will usually resolve themselves into pretty good order, regardless of their number and their nature. —JOHN E. HYLER.

Another New Model

There is considerable difference in designing for sales effect and in changing for increased efficiency; however, in recent years, competition has become so keen in all lines that changes are made for both of these reasons.

In fact these are the two questions uppermost in the minds of product engineers, and these two questions are quite frequently asked of the engineers. Will the change increase the efficiency? What effect will the change have on sales? These two questions therefore have become closely related, and one is seldom considered without the other.

A company is justified in bringing out a new model as soon as changes can be successfully financed. The new model indicates progressiveness, and surely no company can be condemned because it is progressive. —C. F. STAPLES.

There are two kinds of customers: those which have already a compressor, and those that have not yet bought one and are prospective buyers.

For the first class, Al has only to offer parts for replacement, because it is not common to get repeat orders, and for them the stock of semi-finished parts left in the shop is plenty.

But the second class is the most important one, because there is more to be expected from them. Offering a better compressor either with more efficiency or at a lower price is an attraction that Al cannot dispense with.

Industry advances implacably and does not stop for sentimental feelings. Therefore Al is right in marketing a new model of his compressor, without further consideration, provided it happens to be a real improvement over the old one.

—FAUSTO BECERRIL,
Military Engineer, Mexico City.

Designing for sales effect in the machine industry always will be dangerous, for there will always be the dissatisfied customer, who paid the same price, or more, for the old model not many months before the new one was brought out.

But a new model that is more efficient must of course be put on the market as soon as possible. In cases of this sort, it is a good idea to follow the practice of one of the major equipment builders. The plan works as follows: The salesmen are instructed as to the date that the new models will be ready for shipment, and most important of all, are instructed to talk over the problem with all prospective purchasers, to see if they cannot hold off for a little while to get a better article. In cases where immediate delivery is wanted, the customer is always satisfied, simply because the vendor has treated him fair and square and let him know that he would get more for his money by waiting. This plan is followed by a manufacturer who produces a large variety of equipment and is constantly bringing out new models, but no one has as yet heard of one of his customers being dissatisfied with his practice.

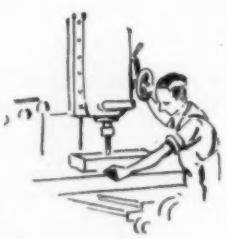
—CHARLES R. WHITEHOUSE,

What's in a Name?

I like Al's firm name of Mason & Morton. Having their own names on the sign should be an incentive to the partners to work hard for a reputation and to do their best to live up to it. Such a name gives the concern a more personal touch. Their employees will feel that they are working for individuals and not for a "soulless corporation."

If Al and his partner intend to make this business their life work, they should put their own names before their buying public. Many concerns adopt a high sounding name for a "shoe-string" business, but I believe that Al and his partner are building for the future.

Many shops branch out in lines quite



foreign to their original plans, and their names are then far from descriptive of their product. Go down to Fall River and you find the great Fall River Iron Works, employing several thousand people. You never heard of it? Well, no wonder, for they make cotton goods in four or five big mills. The name is hardly descriptive of the present business.

Who is the leading tool builder in England? No, it isn't one of those fellows with the long drawn out descriptive names but Alfred Herbert, Ltd. L. S. Starret didn't need any decorations added to his name to make a success, and we all know what Pratt & Whitney make. And so it goes. I could list a hundred more individuals, names. Ninety per cent of the successful machine tool people have their own names on their products. Of course there are a few large concerns with names descriptive of their goods, or locality, but I prefer the personal touch of the maker's name.

A quality product, properly advertised, will go a long way toward making any name good. The name is only as good as the product.

—HERBERT M. DARLING.

Ed is overestimating the value of a new company's name. The success of Al's firm depends upon the reliability, quality and suitability of its products. Any advertising value the firm's name may acquire in the future will come from its continual and favorable association with the firm's products.

The products a company manufactures are to be found in its advertisements, its catalogs, from its salesmen, and in the subject index of trade registers; not in the firm's name.

A flashy firm name may attract but cannot of itself hold trade; it is frequently a disadvantage to its originator. Al has wisely chosen a simple, direct, readily pronounced, and easily spelled name for his firm.—SAMUEL D. BRYDEN.

Borrowing from the Bank

Al's plan to borrow from the bank when he does not need the credit is poor business and will not help him to secure credit when he actually needs it. The old game of borrow and pay back promptly blew up a long time ago, and when Al goes to the bank to borrow $1,000, he will be required to furnish a financial statement and to answer a lot of questions, after which the banker will tell him that he does not need the loan. If Al insists upon having the loan, the banker will suspect that some ulterior motive exists, and a threat to take the account to the Trust Company will not move him. Moreover, if Al goes to the Trust Company he will be asked why he left the National Bank.

Ed is just as wrong in his opinion that a loan should never be obtained from the bank and that the bank wants to take over his business. Banks have had to take over many business concerns, but it was because they had to and not because they wanted to, and nearly every case represents a loss to the banks.

Al can establish credit with his bank without borrowing when he does not need the money. In order to do so, he should file financial statements with the bank, keep it posted on the progress of his business and maintain good balances.

—C. J. MORRISON.

Press Work Pressures

C. W. LUCAS

Guesswork usually plays a greater part than knowledge in selection of the press for the job. To remove the guesswork the author made tests for more than twenty years. Over a thousand of these tests will be reproduced for convenient comparison

OF ALL the subjects coming under the head of mechanical engineering I doubt whether there is one that has had so little written about it as that of how to determine the correct size of press for a given job. It is surprising to find the widely differing sizes of presses that users will specify for the same job.

I have seen a press user operating a toggle draw press of 750-ton capacity to do work that another user was doing successfully in a 150-ton press. The first press represented an investment of $25,000; the second, $8,000. The $25,000 press was operated at a speed of three strokes per minute; the $8,000 press at eight strokes per minute.

The engineer responsible for specifying the larger press was positive that a smaller size would not do the work. When asked how he calculated that a 750-ton press was needed, he admitted having guessed the size. Most press users are doing the same thing. That they are over-cautious and unconsciously use altogether too large a factor of safety is logical when it is remembered that if the guess is too low a new press crankshaft or frame will be required.

There is no fixed rule that can be used to determine the actual pressure required for a given job, but there are methods that will get closer results than merely guessing. And there are many angles to the problem. Presses are required to produce many various shapes and sizes of pieces in many thicknesses and kinds of material. Operations are also varied, such as broaching, bending, blanking, cutting, coining, drawing, embossing, forming and mashing. Each different job is a problem in itself, and the problem can be further complicated by a need for knowing about what pressure is required even before the dies are made. Thus it is impossible to use a hydraulic press to determine the pressure required, and we must fall back upon comparison with similar jobs that have been tested in one of the various ways. Especially does this apply to coining, embossing, forming, mashing, bending and drawing operations.

Results of 1,000 Tests

During the past 20 years I have kept a record of 1,000 or more tests, and these are to be reproduced in *American Machinist*. By comparing some of the tests made with some of the jobs being run in his own shop, the press user can determine whether the press is working to capacity or is overloaded. Some of the tests were made for parts only a few inches in size where the actual job required several feet. The tonnage required was attained by multiplying the result by the ratio of the size of the job to that of the test piece. Many of the tests were made with temporary dies used only for testing purposes.

Tests were made on a testing machine by placing ½-in. square blocks, 1 in. long, between hardened and ground tool-steel bolster plates. By placing dies on top of the bolster plates and tripping the press, the blocks were mashed down in proportion to the pressure exerted. Then by taking another ½-in. square block mashing it down and reading the required pressure, it was possible to obtain the pressure required for the job by multiplying the value thus obtained by the number of blocks used between the bolster plates. Besides making such tests on hydraulic presses, it is also possible to obtain them on hydro-pneumatic cushion equipment.

On some of the test sheets to be reproduced, it is indicated where and how the tests were made. This is particularly valuable in the case of coining, which requires different pressures at different speeds of the press ram.

Riveting Requires Special Precautions

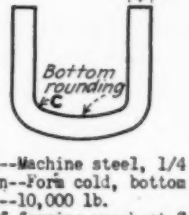
A number of tests of riveting jobs were also made on the testing machine. When selecting a press suitable for forming rivet heads, it is good practice to use one with a capacity 50 per cent greater than the actual pressure required to form the rivet head. This should be done because tests to be illustrated were made with new dies. It often happens that a diesetter tries to get a perfect rivet head with a worn out die which causes the press to exert more pressure than required with new dies. Also, in the case of hot riveting jobs, cold slugs will overload the press. If a hydro-pneumatic overload relief cushion is built into the press or other safety overload device is used, a press capable of exerting the same pressure as that shown on the testing machine may be used. It is to be remembered that riveting operations are among the main causes for broken presses. It is important that a pressure control cushion be used if a press is employed a great deal on riveting operations.

Press Work Pressures

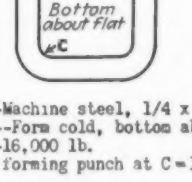
Series I—*Forming*

Material--Machine steel, 3/16 x 1 in.
Operation--Form cold
Pressure--10,000 lb.
Radius of forming punch at C = 3/16 in.

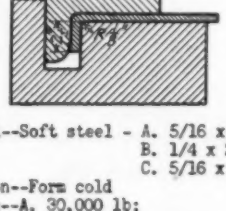
Material--Machine steel, 3/16 x 1 in.
Operation--Form cold, bottom nearly flat
Pressure--14,000 lb.
Radius of forming punch at C = 3/16 in.



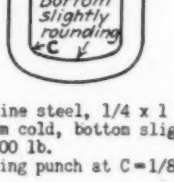
Material--Machine steel, 1/4 x 1 in.
Operation--Form cold, bottom rounding
Pressure--10,000 lb.
Radius of forming punch at C = 1/8 in.



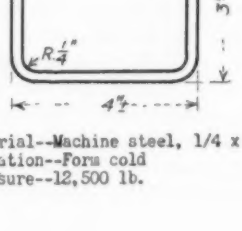
Material--Machine steel, 1/4 x 1 in.
Operation--Form cold, bottom about flat
Pressure--16,000 lb.
Radius of forming punch at C = 1/8 in.



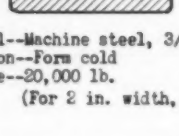
Material--Soft steel - A. 5/16 x 3 in.
B. 1/4 x 2 in.
C. 5/16 x 3 in.
Operation--Form cold
Pressure--A. 30,000 lb;
B. 6,400 lb.
C. 32,000 lb



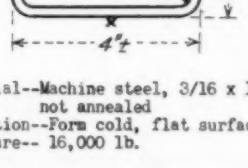
Material--Machine steel, 1/4 x 1 in.
Operation--Form cold, bottom slightly rounding
Pressure--12,000 lb.
Radius of forming punch at C = 1/8 in.



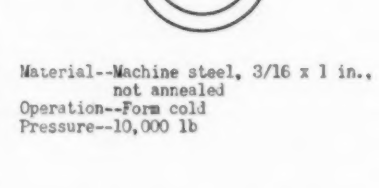
Material--Machine steel, 1/4 x 1 in.
Operation--Form cold
Pressure--12,500 lb.



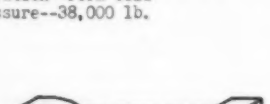
Material--Machine steel, 3/8 x 1 in.
Operation--Form cold
Pressure--20,000 lb.
(For 2 in. width, 28,000 lb.)



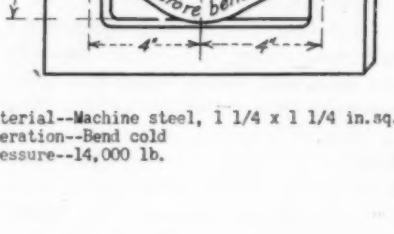
Material--Machine steel, 3/16 x 1 in.,
not annealed
Operation--Form cold, flat surface at x
Pressure-- 16,000 lb.



Material--Machine steel, 3/16 x 1 in.,
not annealed
Operation--Form cold
Pressure--10,000 lb

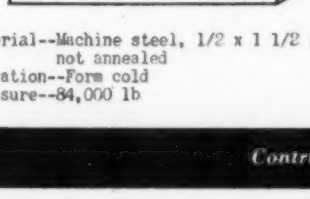


Material--Machine steel, 1/2 x 1 1/2 in.
Operation--Form cold
Pressure--38,000 lb.



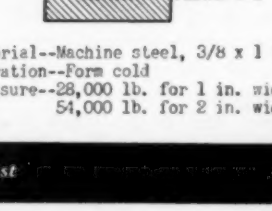
Material--Machine steel, 1 1/4 x 1 1/4 in.sq.
Operation--Bend cold
Pressure--14,000 lb.

Material--Machine steel, 1/2 x 1 1/2 in.
Operation--Form cold
Pressure--49,000 lb.



Material--Machine steel, 1/2 x 1 1/2 in.,
not annealed
Operation--Form cold
Pressure--84,000 lb

Material--Machine steel, 1/2 x 1 1/2 in.
Operation--Form cold
Pressure--71,000 lb



Material--Machine steel, 3/8 x 1 in.
Operation--Form cold
Pressure--28,000 lb. for 1 in. width
54,000 lb. for 2 in. width

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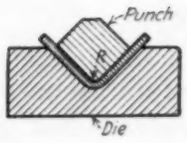
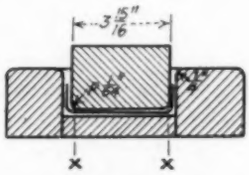
Press Work Pressures

Series I—*Forming*

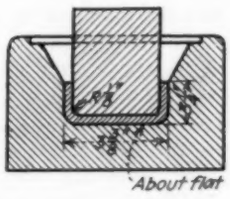


Material--Machine steel
Operation--Form cold

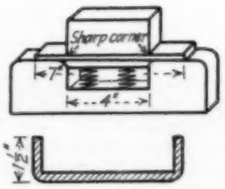
Thickness	Width	Pressure	R
3/16"	1"	12,800 lb.	1/32"
3/16	2	24,900	1/32
3/16	3	35,200	1/32
3/16	4	51,600	1/32
3/16	1	12,000	1/8
3/16	1	10,700	1/4
3/16	2	19,600	1/4
3/16	3	35,200	1/8
3/16	4	48,200	1/8
3/16	4	42,200	1/4



Material--Soft sheet steel, 0.030 in. thick
Widths-1 and 2 in.
Operation--Form cold, bottom flat, except slight rounding at x-x
Pressure--1-in.width, 350 lb.
2-in.width, 600 lb.

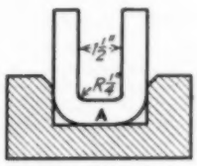


Material--Machine steel blank, 5/32 x 6 in.
Operation--Form cold
Pressure--48,000 lb.

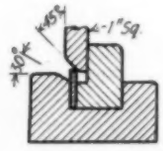


Material--Soft steel, 0.075 x 1 in.
Operation--Form cold, bottom flat
Pressure--1,400 lb.

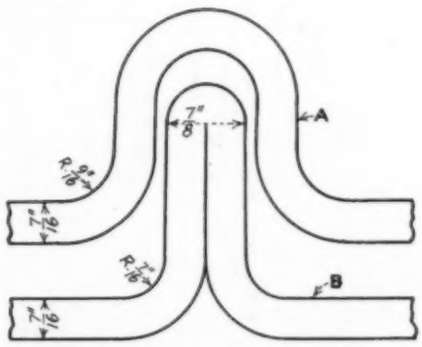
Material--Steel, 0.014 x 4 in.
Operation--Form cold
Pressure--A-200 lb. (50 lb. per in.)
B-400 lb. (100 lb. per in.)



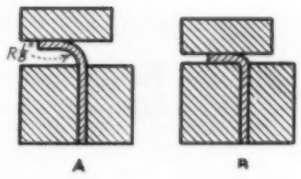
Material--Machine steel, 1 in. round
Operation--I. Form bottom at A slightly rounded
II. Form bottom at A nearly flat
Pressure--I. 40,000 lb.
II. 80,000 lb.



Material--Machine steel:
A - 7/32 x 1 in.
B - 7/32 x 3 in.
Operation--Form cold to 45 deg. and to 30 deg. angles
Pressure--A - 45 deg., 3,000 lb.
30 deg., 12,000 lb.
B - 45 deg., 6,000 lb.
30 deg., 20,000 lb.

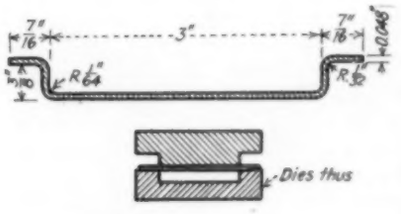


Material--Machine steel, 7/16 x 1 in.
Operation--Form cold
Pressure--Piece A--34,000 lb.
Piece B--100,000 lb. to close



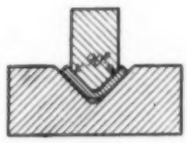
Material--Soft steel, 5/64 x 3 in.
Operation--Form bent piece at A to piece at B with sharp corner
Pressure--1,500 lb., 500 lb. for each inch of width

Material--Decarbonized steel, 0.062 x 1 in.
Operation--Expand one-third circle at A to piece at B
Pressure--1,200 lb.



Material--Soft steel
Operation--Form cold, bottom rounded about 1/64 in.

Width	Pressure
1 in.	2.6 tons
2	3.75
3	4.5



Material--Soft steel
Operation--Form cold

Thickness	Width	Pressure
5/16 in.	3 in.	31 tons
1/4	1	11.2
1/4	2	17.5
1/4	3	24.0

Contributed by C. W. LUCAS

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• IDEAS FROM PRACTICAL MEN

Grinding Drills for Deep Holes

K. CRABILL

We had to drill three deep holes in a quantity of steel forgings, one of which is shown in Fig. 1. Due to delay in the perfection of a special drilling machine for this job, it was necessary to start the work in a single-spindle drill press, using a temporary jig.

Approximately, the first three inches could be drilled without stopping, using the automatic feed, but thereafter it was necessary to back out the drill about every half inch to clear the chips from the holes. The sequence of operations was as follows: (*a*) Drill with a $\frac{31}{64}$-in. undersize drill; (*b*) redrill or ream to size to secure clean holes; and (*c*) counterbore, using a piloted counterbore. With loading and unloading the jig, grinding drills, etc., the operator averaged two pieces per hour.

An increase in the schedule made it necessary to transfer the job to a four-spindle drill and to make duplicate jigs. So that the operator could load and unload one jig while pieces in the other jigs were being drilled, it was necessary that automatic feed be used without stopping to clear the holes from chips. This necessitated finding some way to prevent the chips from clogging the holes. We finally got over the trouble by grinding the drills as shown in Fig. 2 at *A*. The drills were ground by hand to the conventional shape to obtain the correct center. Then the edges were notched by the edge of the wheel, leaving the cutting edges at right angles to the body and leaving a tit in the center. The sleeve gage *B* was used to insure that both cutting edges were alike.

The shavings from drills travel at right angles from the cutting edges. With drills ground to the conventional shape, the shavings travel toward the center, curve, and in a deep hole they break, choking the drills and often causing them to break. Shavings from drills ground as shown in Fig. 2 at *A* travel parallel with the body and follow the flutes, thus clearing the holes. The shavings from the main cutting edges carry with them the chips from the central tit and a shaving similar to that shown at *C* is formed.

Grinding the drills in the manner described made it possible to do away with redrilling or reaming the holes, since they were not galled by small chips. A drill the size of the counterbore, and ground like the other drills, was used to start the holes to the depth of the required counterbore, thus the counterboring and providing the starting centers for the drills were combined in one operation. After the holes were well started, the bushings were removed from the jig to give greater shaving clearance for the drills.

The results from these changes were that the operator was able to handle the work under three of the spindles without assistance, and that instead of two pieces per hour, his average was seven and one-half pieces.

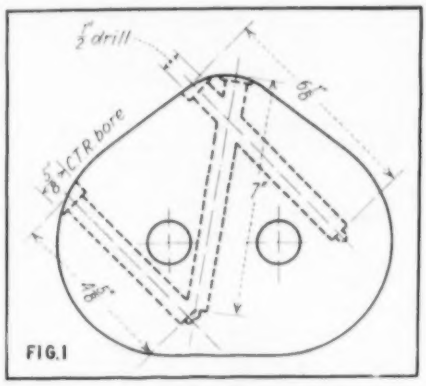


Fig. 1—How the holes made a continuous oil passage in the crank web

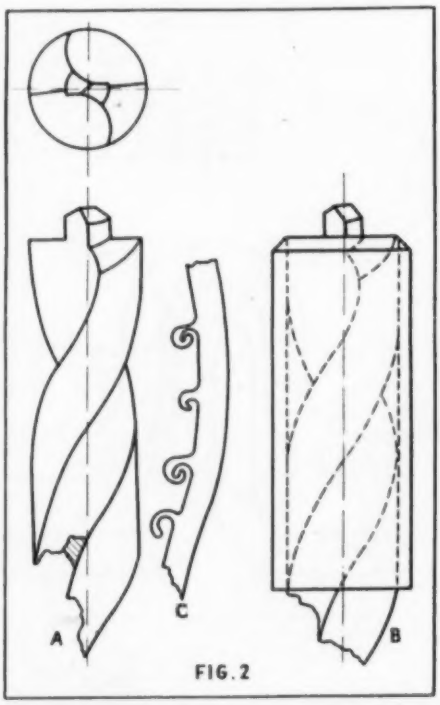
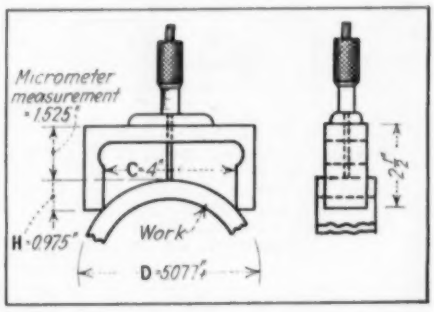


Fig. 2—The point gage used in grinding and the chip produced

Finding the Diameter Where the Center Is Not Accessible

PAUL C. BRUHL

With the aid of a micrometer depth-gage, the device illustrated can be used to find the diameter of a circular piece where any considerable section of the circumference is available, and where the center is not accessible. With the device made to the dimensions given, diameters from 4 to 6 in. can be accurately determined and diameters from 6 to 16 in. can be very closely approximated. For accurately determining diameters above 6 in., the gap *C* should be made larger and the other parts in proportion.



Measuring the height of an arc to find the diameter or radius

To use the device, place it on the work to be measured and bring the spindle of the micrometer depth-gage into contact with the work. Take a reading to the third decimal place and subtract the reading from the height of the device. The remainder will be the dimension *H*. The diameter *D* can then be found by the following formula:

$$D = \frac{(\frac{1}{2}C)^2 + H^2}{H}$$

Where

D = the diameter of the piece,
C = the distance between the legs of the device, and
H = the height of the device minus the reading of the micrometer depth-gage.

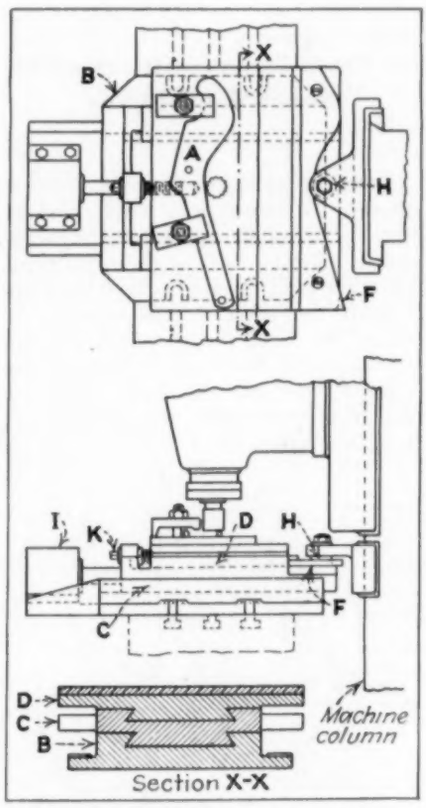
Let the reading of the micrometer depth-gage be 1.525 in. and the height of the device 2.500 in., then $H = 2.500 - 1.525 = 0.975$ in.; $C = 4$ in. and $(\frac{1}{2}C)^2 = 4$ in.

$$D = \frac{(4 + 0.975)^2}{0.975} = 5.077 \text{ inches.}$$

A Profiling Fixture

DUDLEY L. CURTIS

The fixture illustrated is used for profiling the piece *A* in a milling machine, using the vertical spindle attachment. It consists essentially of the base *B;* the intermediate slide *C;* the upper slide *D;* the hardened former *F;* the hardened roller *H,* mounted in a bracket attached to the machine column; and the air cylinder *I*. The work is mounted on the upper slide, being located by dowel pins and held by clamps. This slide can be adjusted independently of the intermediate slide by the screw *K*, so that the work can be brought toward or away from the cutter without disturbing the relative positions of any of the other members. On the rear part of the intermediate slide is mounted the former, which is held in contact with the roller by pressure from the air cylinder through the piston.



Details of profiling fixture showing how work is held and how contour is controlled by former at rear

As the table travels longitudinally, carrying the work past the cutter, the former passes the roller and, being kept against it by pressure, moves the intermediate slide in or out to conform with the profile. Since the upper slide carries the work and moves in unison with the intermediate slide, the work travels in a path of the same shape as that of the former. Thus the cutter, which is at a fixed distance from both the roller and the former, profiles the work to the outline of the former.

The fixture can be used for profiling any shape within its limits by the use of a former having the desired profile. Both the slides are dovetailed and travel at right angles to the table traverse. The pressure in the air cylinder is controlled by a regulator, so that the pressure of the former against the roller is always the same. The roller should be of the same diameter as the cutter.

Press Tools for Piercing Cups

CHARLES KUGLER

The tools illustrated were made for piercing five ¼-in. holes in brass cups ⅛ in. thick, such as the one illustrated. Four of the holes are in the sides of the cups, while the fifth hole is in the tops.

In operation, a cup is placed over the round block *B* and resting on the ejector springs *C*. When the ram descends, the pressure plate *D* forces the cup into place, compressing the springs *F*. Further descent of the ram brings the posts *H* into contact with the plungers *I*, forcing them downward so that their conical heads force the four side punches *K* inward, piercing the holes in the side of the cup. At the same time, punch *L* pierces the bottom.

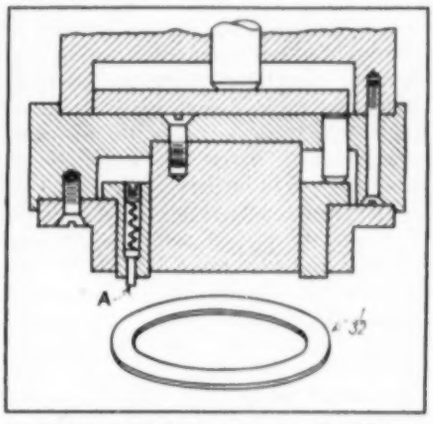
At this time, all the springs are in compression, but when the ram ascends the pressure is relieved and the springs return the parts they control to their normal positions. The ejector springs *C* raise the cup slightly so that it can be easily removed from the block. The guide blocks *M* for the side punches are cold-rolled steel and are forced into the die base. Bushings *N* for supporting the plungers *I* are a force fit in the base and are also of cold-rolled steel. Holes in block *B* are provided to permit the slugs to pass through.

A Positive Stripper

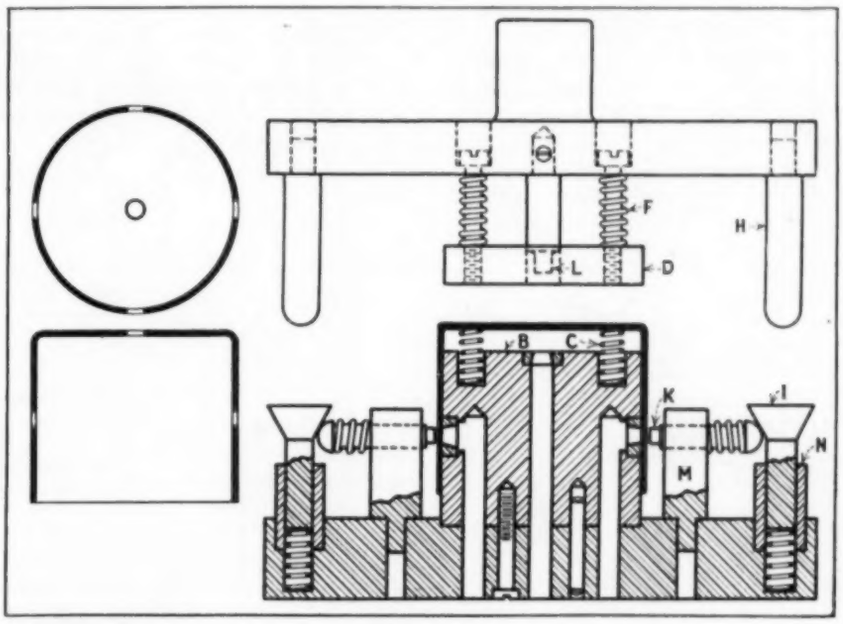
CHARLES H. WILLEY
Superintendent of Manufacturing, Hoyt Electrical Instrument Works

In blanking light parts, we had considerable trouble from their sticking to the stripper, due to the adhesiveness of the lubricant used on the stock.

To eliminate this trouble we have made the strippers on all of our new tools as shown in the illustration. Spring-actuated ejector pins *A* are put



Spring-actuated stripper pins give positive action to overcome adhesiveness of lubricant used in blanking light parts



Punching holes in bottom and four sides of a drawn cup. Note passages for discharge of metal punched from holes

in the strippers. These pins separate the blanks from the strippers and, since their surface is small, the weight of the blanks is sufficient to overcome the adhesiveness of the lubricant, consequently, positive stripping is assured.

Press Tools for Forming Rectangular Work

LOUIS M. HANSEN

The press tools illustrated are for forming rectangular frames for retaining the rubber sealing strips for an electric sleet-frost shield, and are made of No. 1 hard, cold-drawn flat steel wire 0.042x¼ in. A formed piece is shown in heavy lines in the die. The stock is approximately 43 in. long before being formed, the formed dimensions being approximately 7x15½ in. Eight holes are pierced in each piece previous to the forming operation. Since the press in which the work is done has a stroke of but 3 in., it is necessary to use cam-operated tools to get the amplitude of motion required for the work.

The stock is placed in the die between the pressure pad *A* and the forming block *B*, the pilot pin *C*, carried by the pressure pad, engaging one of the pierced holes. On the first part of the downward stroke of the ram, the cams *D* contact with the sliding blocks *F*, which are connected by the links *H* to the forming block. This construction permits laying the work in place and removing it after it has been formed, without interference.

As the downward stroke continues, both the form-block *B* and the work are carried to the rear, the work passing between the stationary rollers and the forming block, bending the work into a U-shape. At this point, the straight parts of the cams enter between the blocks *F*, which remain stationary during the remainder of the downward stroke.

During the latter part of the downward stroke, the cam *K* comes between the rear ends of the bars *L*, which carry the rollers *M* on their front ends and are pivoted in the yoke *N*. These bars are held in the open position by the spring *O* until their front ends are brought up against the lower surface of the die-plate, thus carrying the rollers *M* into position for bending the ends of the stock about the forming block *P*. The rear ends of bars *L* are further separated by the continued downward travel of the cam *K*, the front ends being brought toward each other, causing the rollers *M* to bend the ends of the stock about the forming block *P*. Bars *L* also carry the spring pressure-pads *S*, which contact with the stock and press it into undercut surfaces in the sides of the forming block *P*, thus causing the inner angles of the work to be less than 90 deg. and allowing for the stock to spring open slightly after being formed.

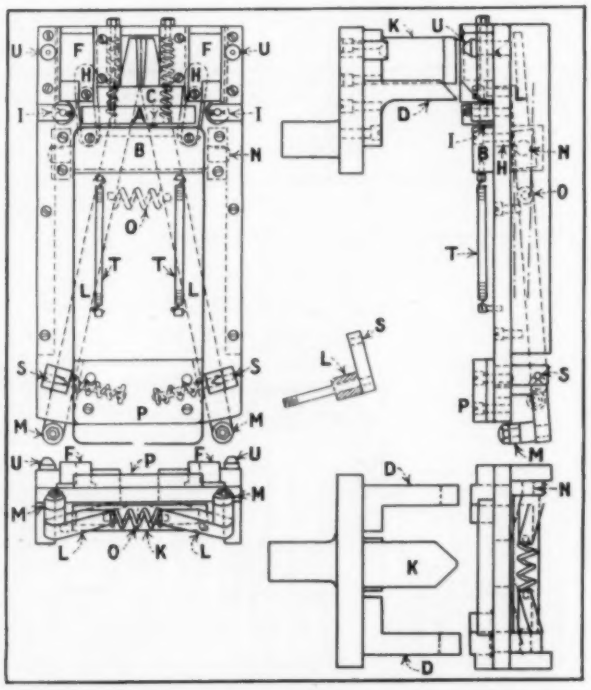
As the ram starts to ascend, and the cam *K* comes from between the rear ends of bars *L*, the front ends of the bars are spread apart by the action of the spring *O* and these ends then drop below the die-plate by gravity. The pressure pad *A* and the forming block *B* both travel forward and carry the work to the position shown in the illustration. Springs *S* carry the forming block *B* far enough forward to allow plenty of room for inserting the stock and removing the finished pieces.

The tools described are operated in a back-geared press having a 3-in. stroke and running at about 120 strokes per min. The cams are so timed that there is no difficulty in bringing the long ends of the stock into position before the rollers *M* come above the surface of the die-plate. Conical pins *U* and the bushings *V*, respectively, are provided for locating the punch and the die in the set-up, as well as for setting the shut height of the press.

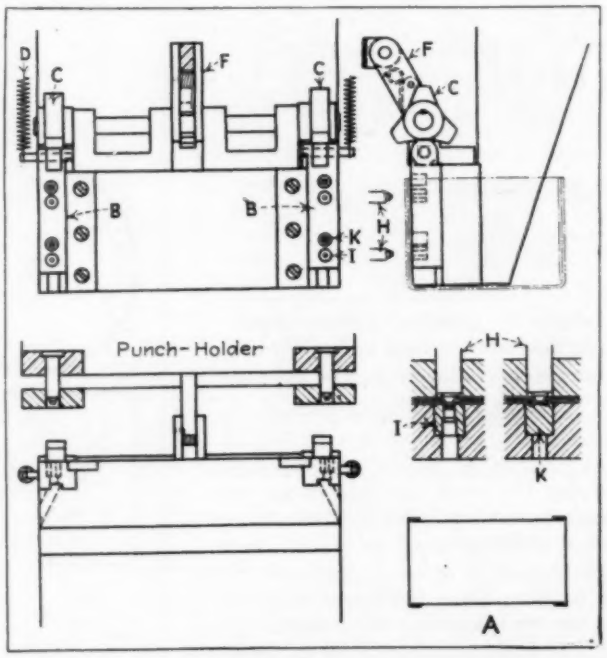
Press Tools for Riveting Sheet-Metal Boxes

ANDREW BEUSCH

Every so often we have to make a quantity of boxes from 0.062-in. sheet steel. The blanks are cut out in shears and in notching tools of the usual type. They are then formed so that the ends overlap the sides at the corners, as shown at *A* in the illustration. The overlapping ends are spot riveted to the sides in two places at each corner by the tools illustrated, the work being done in a horn press.



Wedges, levers and springs are used in combination to form rectangular frames for frost shields



Cam operated slides carry punching dies and riveting anvils into position. The same punches are used in both piercing and riveting thin sheet metal boxes

The same punches are used for both piercing and riveting, the dies, of course, being different. The dies are held in the slides *B*, which are operated by the two three-lobed cams *C* and the springs *D*, the cams being intermittently rotated by pawls and ratchets through levers *F* connected to the ram. When the press is tripped and the punches *H* descend, they force the metal into the piercing dies *I* and cut slugs from the under sheet only, the metal in the upper sheet being bulged through the holes in the under sheet.

As the punches ascend, the cams move the slides forward, bringing the riveting anvils *K* in line with the punches. When the press is again tripped, the punches spread out the bulged material, forming heads on the under side of the under sheet. On the up stroke, the slides are returned to the piercing position by the springs. When the corners at one side of the box have been riveted, the box is removed from the horn, turned half-way around and replaced. The former operations are then repeated.

Indexing by Means of Disks

HOMER COY
Studebaker Corporation

Six equally spaced holes were to oe drilled in a circle in the driving flange of a large shaft. The shaft was clamped in V-blocks mounted on the table of a horizontal boring mill. For indexing, a plate having three hardened and ground disks of the same size attached to it was clamped to the flange of the shaft, as shown in Fig. 1. The shaft was rotated until the upper edges of disks *A* and *B* were parallel with the machine table, being indicated with a dial indicator. Then the first hole was drilled.

For the second hole, the shaft was rotated until the lower edges of disks *B* and *C* were parallel with the table, as shown in dotted lines. For the other holes, the shaft was rotated until the disks *A* and *C; A* and *B; B* and *C;* and *A* and *C* were brought successively parallel with the table. For holes 1, 3 and 5, the top edges of the disks were indicated, and for holes 2, 4 and 6 they were indicated at the bottom edges. It will readily be seen that the flange could have been indexed for three holes by skipping alternate settings.

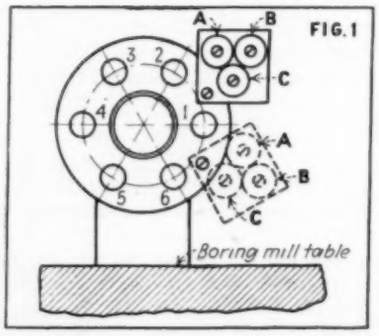


FIG. 1

Using a disk and block combination to space holes in a flange

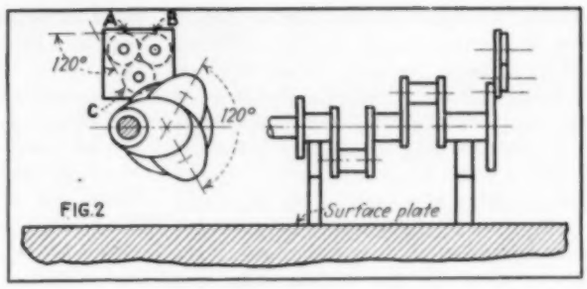


FIG. 2

Showing how the same combination can be used for indexing an experimental six - throw crankshaft either in turning, grinding or checking

This method can also be used for indexing experimental six-throw crankshafts in turning, grinding and checking, as shown in Fig. 2. In these cases the plate containing the disks may be attached to the rear flange, or to any other convenient part of the shaft that has been machined. In turning or grinding, after the first pair of crankpins have been machined, the upper edges of disks *A* and *B* being parallel with the lathe bed or the table of the grinder, the crankshaft is rotated in the throw blocks until the upper edges of disks *A* and *C* are brought parallel with the bed or the table of the machine. Then the second pair of crankpins are machined. For the third pair of pins, the crankshaft is rotated in the throw blocks until the upper edges of disks *B* and *C* are parallel with the bed or the table.

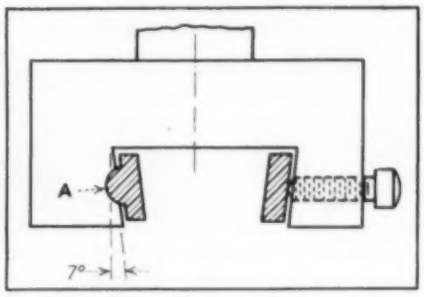
In checking the crankshaft, the main bearings are placed on parallels to prevent sag, the parallels being mounted on a surface plate. The crankpins are held in position by wooden wedges placed under the pins that are not being checked. Rotating the crankshaft as in turning or grinding will bring the crankpins into checking position.

Adapting Holders to Press Tools of Various Angles of Dovetail

ROBERT R. CORNELL
Division Superintendent, Gorham Company

We have a quantity of press tools that were made many years ago, some of them having been purchased from different plants. The angles on the dovetails of the punch-plates vary from 7 to 15 deg., so that not all of them will fit our punch-holders, the angle of which is 7 degrees.

To adapt our punch-holders to the various angles, we planed half-round grooves in the dovetails and fit rocking gibs having half-round tongues to fit the grooves, as shown at *A* in the illustration. In holding the punches, these gibs would rock sufficiently to accommodate themselves to the various angles



A rocking gib makes it easy to adapt press tool holders

on the punch-plates. The regular gibs on the opposite sides of the dovetails would, of course, rock on the points of the gib-screws to conform to the angles on the various punch-plates. The die-holders were fitted up in the same way.

A Dog Tightener

HERBERT M. DARLING
Tool Engineering Service

When turning a quantity of short pieces in the lathe, the operator loses a lot of valuable time in dogging his work. This is noticeable when he has to grab a wrench to tighten or loosen the dog on every piece he handles.

To eliminate this loss of time, we use the cast-iron block shown in Fig. 1,

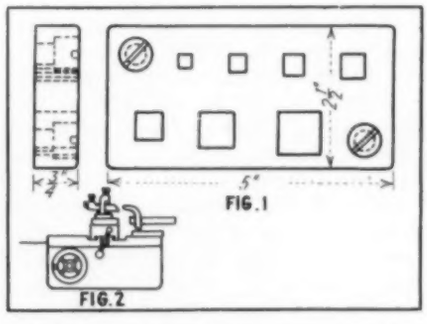


FIG. 1

FIG. 2

Wrench plate with openings to suit different lathe dog screws

which has openings that are a free fit for the screw heads on the different sizes of dogs we use. This block is fastened to some convenient place on the lathe carriage, as in Fig. 2. After the operator puts the dog on his work, he inserts the screw head in the correct hole, holding the work in his hand and swinging it to tighten the screw. After turning the work, he again inserts the screw head in the square hole and swings the work to loosen the dog. This device saves considerable time when turning short pieces, such as blanks for taps, reamers and so forth.

Closer Limits in Layout Work—*Discussion*

MATTHEW HARRIS

In an article under the title given above (*AM*—Vol. 76, page 1075), Hart F. Wright tells how to get close measurements by dividing the dimension into two parts, the first of which is obtained by setting the dividers to the nearest $\frac{1}{32}$ in. on a scale and the remainder by setting them to the 0.025-in. lines on the barrel of a micrometer. It seems to me that it would be a hard matter to prevent the divider point from slipping on the smooth, round barrel of the micrometer.

But why not take the whole measurement at once from a vernier caliper? Nearly all vernier calipers have points on the beams and on the slides so that dividers can be set by them for transferring measurements. By this means the dividers can be set to any 0.001 in. within the range of the instrument. There is no danger of the divider points slipping, since the points on the calipers are deep enough for them to get a good hold. The only danger to be guarded against is an error in reading the vernier scale.

Getting Dimensions from Assembled Machines

ERNEST C. ALLEN

When making sketches from assembled machines it is often quite a problem to get the necessary dimensions. The difficulty may be due either to the inaccessibility of the parts to be measured, or to their being of a more or less immeasurable shape.

Many of the measurements may be gotten by means of paper rubbings. The contour of a cam; the center distances and the layout of a group of bolt heads; the size and shape of gear teeth; and many other parts can be accurately measured and recorded by placing a sheet of paper on the more or less oily part and rubbing the opposite side with the fingers. The diameters of round parts not otherwise measurable can be found by wrapping a narrow strip of paper around them, marking the lap and afterward dividing the length by 3.1416. When not in mesh, the same may be done with gears, and the paper will record both the diameter and the number of teeth.

While strips of paper cannot be wrapped around gears that are in mesh, a rubbing of any large fraction of the surface at the sides will furnish a record from which, by means of the dividers, the diameter and the number of teeth can be determined. In the case of cylindrical parts having details such as holes, slots, or cam grooves on their surfaces, accurate measurements by the usual methods are well nigh impossible. However, paper rubbings of such parts will give a complete and fairly accurate record from which the diameter and the location of all surface details can be obtained.

A New Use for Old Razor Blades

C. COLE

For the draftsman who does much tracing, which also calls for some erasing, a scratcher, or eraser, is efficient and cheap. Gummed paper or linen is wrapped around one end of a worn-out safety-razor blade. The other end of the blade is then broken so as to leave a sharp point. When the point becomes dull it is necessary only to break off another small piece to form a new point. We have been using such scratchers for some time and they have proved to be satisfactory.

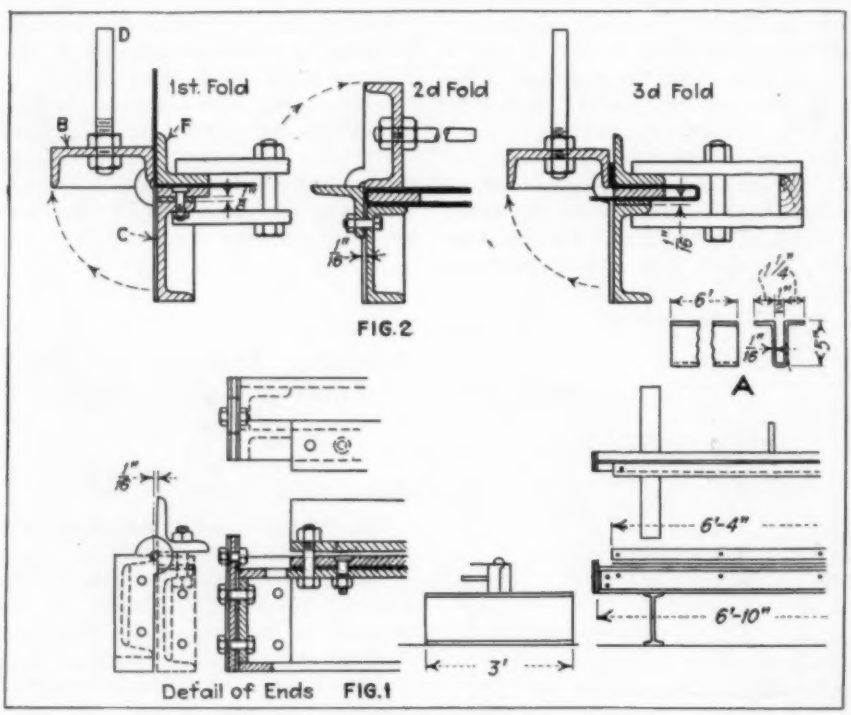
An Improvised Folding Brake

DUNCAN HOUSE
Richmond, Surrey, England

We had a quantity of sheets of $\frac{1}{16}$-in. steel to be folded into U-shapes having flanges, as shown at *A* in the illustration. Since we had no folding brake large enough to do the work, we improvised the one illustrated. It is made of channels, an angle iron and some flats, and it rests on I-beams, the general layout being shown in Fig. 1. The details in Fig. 2 show the folding part of the device and also the stages of folding.

The folding channel *B* is hinged to the stationary channel *C*, being provided with the operating lever *D*. For the first fold, the sheet is clamped between a pair of spacers on top of the stationary channel and the angle iron *F*, and the fold is made by swinging up the hinged channel *B*. For the second fold, the angle iron is removed and is attached to the back of the stationary channel. The thinner spacer is taken out and the thicker one is placed on top of the sheet. This fold completes to U-shape.

For the third fold, forming one of the flanges, the angle iron is put over one



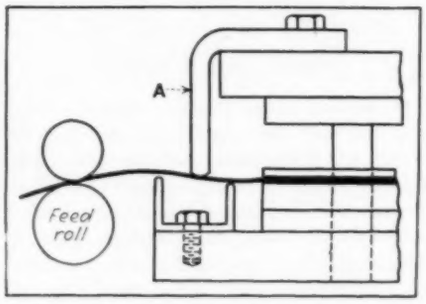
Combining channels, angles and flats to secure folds of various kinds without the use of a large brake for small lot work

of the legs of the channel and a spacer is put between the legs of the U, the angle iron being clamped to the work. Swinging up the bending channel bends one of the flanges. Bending the other flange is a repetition of the third fold, the work being turned over end for end. Each operation was performed on all of the sheets before any changes were made for the succeeding ones. A piece of pipe slipped over the lever *D* gave leverage enough for the work.

Straightening Coiled Stock

FRANK F. SMITH

As a matter of economy, our engineering department decided to purchase all punching steel up to 0.062x6 in. in coils instead of in flat strips. Consequently, I was confronted with the problem of feeding this quarter- and half-hard coiled stock through dies that had very little stripper clearance. In



Intermittent straightener for unkinking half-hard coiled stock on the press

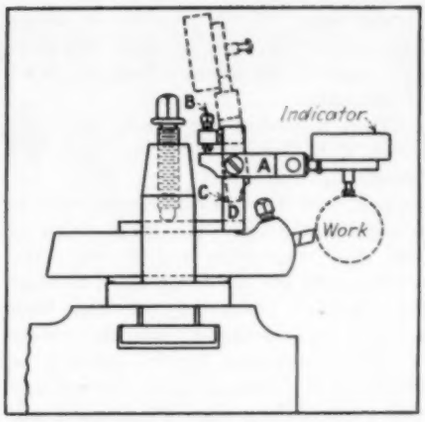
fact, it was impossible to pass the stock between the strippers and the dies, due to its curvature. Rather than go to the expense of changing the strippers on all of the dies, I devised the straightening device illustrated.

A piece of steel *A*, about 6 in. wide and bent to a right angle, was attached to the punch-plate, and two pieces of angle iron were attached to the bolster, as shown. Just before the blanking punch contacts with the stock, the steel piece *A* strikes the stock midway between the angle irons, straightening it enough to permit it to pass under the stripper. This device worked better than I had expected and I had no further trouble from the coiled stock.

A Rapid Gaging Device

PETER L. BUDWITZ

In the device illustrated, a test indicator is employed for checking the diameter of lathe work during the process of turning. It is placed over the toolholder and is held in position by the toolpost screw.



Checking size of lathe work without stopping the cut with indicator on toolpost

The dial indicator is attached to the pivoted lever *A* by means of a thumbscrew and can be swung up out of the way, as shown by the dotted lines, after the gaging has been completed.

In use, the first piece of work having been turned to the correct size, the indicator is brought into contact with it and is set to zero by adjusting the stop screw *B*. To check each piece of duplicate work without stopping the lathe, the indicator is swung down, bringing its spindle into contact with the revolving work. If the indicator reads zero, then the work is of the correct size. If it reads above zero, it will show the number of thousandths to be removed from the work. Thus much time can be saved in repetitive work.

The spring-actuated stop pin *C* holds the lever *A* in the neutral position and prevents the indicator from falling onto the work. The upright *D* is welded to the part that is clamped above the toolholder.

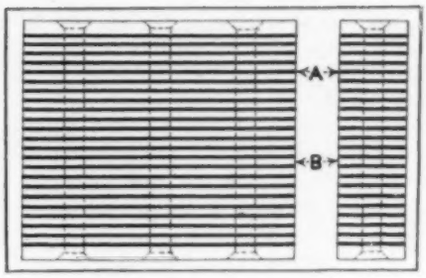
A Magnetic Block

CHARLES F. KRAUT

The article "Parallels for Magnetic Chucks," by W. T. Sovitsky (*AM*—Vol. 76, page 1044) is interesting and the parallels described are especially adapted for long pieces of work having shoulders.

Another useful device to facilitate accurate grinding operations is a magnetic block that can be located anywhere on the surface of any magnetic chuck. The accompanying illustration shows a laminated magnetic block of convenient size, 1x2½x3 in. It is made of 23 strips of 3/32-in. sheet brass, as at *A*, and 22 strips of 1/16-in. cold-rolled steel, as at *B*. The brass and the steel are in alternate layers and are clamped between two strips of 1/8-in. cold-rolled steel by ¼-in. brass rivets, forming a solid block.

When the block is placed on a magnetic chuck and the switch is turned on,



Blocks of alternate strips of brass and steel for use with magnetic chucks

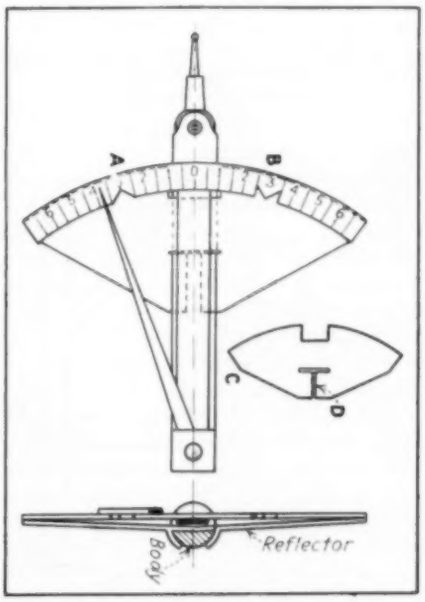
the magnetic current passes through the block, energizing it and also any piece of work that may be placed on it, thus holding them securely. Many otherwise difficult grinding operations may easily be performed by the use of a magnetic block in conjunction with an accurate angle iron, a V-block, a sine bar, or other device.

I make no personal claim of originality pertaining to the design of the magnetic block, but do know that it is not so well known as it deserves to be.

Improvement in Indicators

JOHN ALQUIST

The type of indicator illustrated is popular because of its extreme sensitiveness. However, on account of its natural steel-gray color, some difficulty was experienced in noting the position of the needle on the scale. An improvement in this respect was made by filing a 90-deg. notch at the figure 3 on one side of zero, as at *A*, and two 45-deg. natches, one on each side of figure 3 on the op-



Notches of distinct shapes make it easy to read sensitive indicator

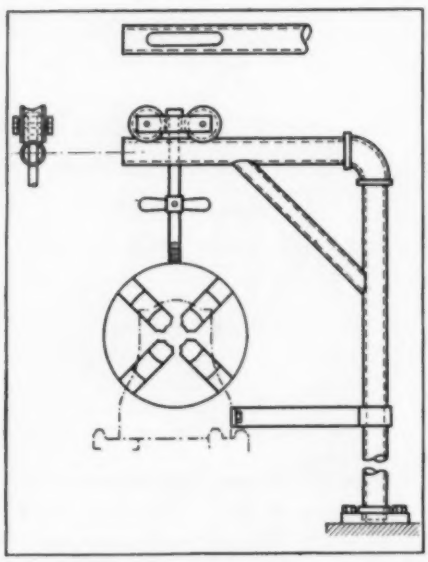
posite side of zero, as at *B*. The two latter notches make it possible to make a reading of plus or minus 0.0005 in. at this point. It was surprisingly easy to see the needle at the notched points, but the scale and the needle being the same color, it was not easy to distinguish the position of the needle on the scale at other points.

To overcome this difficulty, a light reflector was made from white cardboard about 0.008 in. thick, as shown at *C*. The reflector is shaped as shown and is slit at *D* to form flaps to be bent about the body of the indicator. Lines are drawn on the reflector to coincide with the figure 3 on each side of zero. With the reflector in place it is easy to see the position of the needle at all parts of the scale. In attaching the reflector, its center is kept away from the moving parts of the indicator, and the outer edge is placed beneath the scale, the ends being bowed against the ends of the scale. With the notches and the reflector, nothing is left to be desired in either the appearance or the operation of the indicator.

A Chuck Crane for the Lathe

W. S. BROWN

A very convenient aid to quick changeovers from chuck work to work on centers is the crane illustrated. It is made of pipe and fittings and the strut is welded to the mast and to the jib. Besides speeding up the removal or replacement of the chuck, the crane also eliminates the risk of injury to the operator's fingers, which could easily result from a slip when handling the chuck in the usual way. When the chuck is not in use, it hangs conveniently on the crane, the jib of which is swung back out of the way, and yet is within easy reach of the operator from the front of the lathe.



Handling and storing heavy lathe chucks on a home-made crane

When removing the chuck from the lathe, it is first jarred loose from the spindle in the usual way. Then the tapped hole for the suspension rod is brought to the top. The jib is swung so that the suspension rod is over the tapped hole, the rod being lifted to clear the chuck. After the rod has been screwed into the tapped hole, the spindle is rotated backward, thereby running the chuck off of the spindle nose without any risk of its falling, since the support rod takes the weight. The trolley is then run back and the crane is swung so that the chuck is clear of the lathe.

SEEN AND HEARD

JOHN R. GODFREY

Tool Marks in Old Bearings

Wearing parts present some almost unbelievable peculiarities. I have seen a countershaft bearing almost cut in two by an oiler ring that supposedly ran free on the shaft to carry oil from the reservoir below to the top of the shaft. Now a friend tells me he has just pulled down an old Stoddard-Dayton automobile motor and can see the tool marks still on the case-hardened cams. It wasn't called carburizing in those days. These cams, he tells me, were turned with a single point tool by a special attachment on an automatic screw machine, being pinned on the camshaft as was the practice at that time. Lubrication, materials, surface speed, load and impact all play their part in bearing wear. But we evidently have a lot to learn about these various factors.

Accuracy With Calipers—and Feel

The recent discussion on accurate calipering is extremely interesting to an old timer. Most of us could add numerous examples to those given. I knew railroad shop men who could tell very closely the pressure that would be required to force an axle into a wheel, both fits being measured with hand calipers.

We are apt to overlook, however, the fact that nearly all measuring done by hand, no matter whether we use an old firm-joint caliper or a precision gage, depends on the "feel" of the individual. I have seen work accepted or rejected because one man let the gage drop over by its own weight while the other insisted on forcing it over with a very appreciable pressure. Only indicating gages, electrical or otherwise, can eliminate the personal factor. "Feel" can be very sensitive, a difference of two millionths being noticeable as shown in recent tests. The only trouble is that all men do not feel alike, or interpret the "feel" in the same way.

T-C Tools Need Rigid Machines

Progressive railroad shop men frequently have difficulty in trying out new ideas because of lack of equipment. One shop which has several hundred locomotives to keep in repair has tried to use T-C tools without much success because of the inability to get sufficient speed to make it worth while. In one case where the speed was O.K. the tips of the tools came loose, presumably on account of the lack of rigidity in the machine. This defect does not show up in the same way with other cutting tools but has its effect on the work. Good equipment means longer life to repairs as well as lower repair costs.

Shoes and Wedges

Shoe and wedge practice varies widely on different railroads. A number of roads are using brass while others stick to cast iron. One large road casts brass liners on the sides of the driving boxes and uses cast-iron shoes and wedges between the box and the frame. Others use steel wear plates either on the frame or the box with brass shoes and wedges. The brass shoes and wedges are milled on a planer-type machine in one-quarter the time taken by the former method. And though the brass used runs into considerable money it is used over again when worn to the limit.

New Things Not So New

It's a little startling to find how many "new" things have been known for years. "Profile" steel, which is tool or high-speed steel rolled into various sections that can be made into tools with forging or milling, is not generally known, or used. This paper had a very interesting article by H. M. Darling on its applications only last year. Yet this steel was illustrated in the *American Machinist* in February, 1908.

Welding under water is also a recent achievement. But in September, 1908, this paper described a method which I happened to see demonstrated where welds were made under water with only city gas as a fuel. Compressed air at one-pound pressure was mixed with the gas and then a 50-pound jet of air blew the water away from the joint while the weld was made. It's a bit disconcerting to find how some of the old-timers appropriated our brand new ideas.

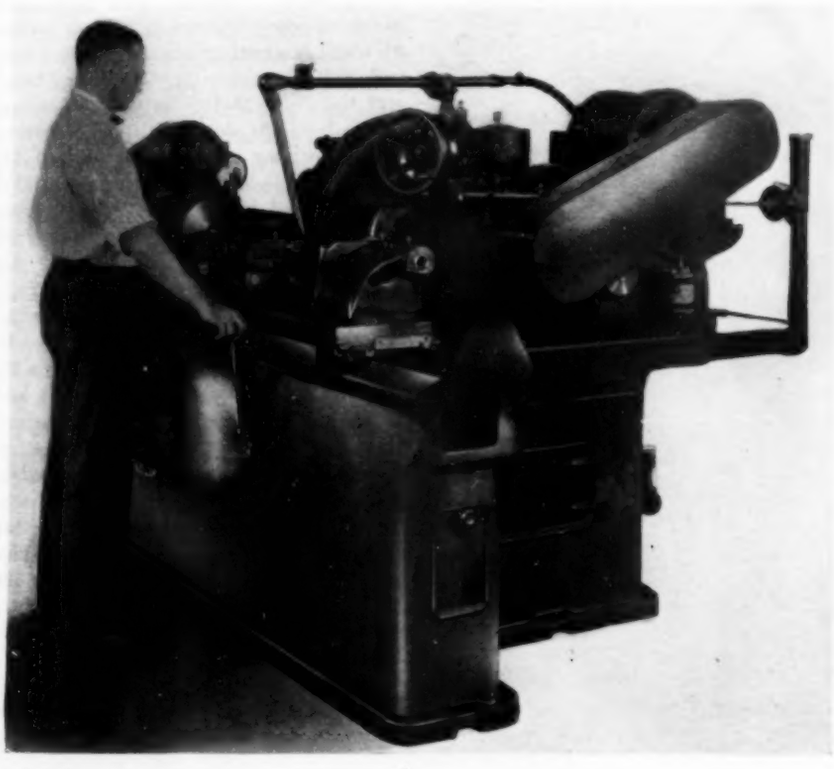
SHOP EQUIPMENT NEWS

Landis Type C 10-In. Plain Hydraulic Grinder

To supplement the Type C 6-in. plain hydraulic grinder (*AM*—Vol. 71, p. 512), the Landis Tool Co., Waynesboro, Pa., has added a 10-in. size. Such work as motor armatures, shafting and camshaft line bearings may be assigned to the machine. It is particularly recommended for the grinding of crankshaft line bearings of practically all shafts, except the exceedingly large and heavy ones. Controls are grouped.

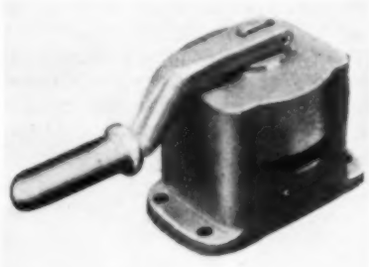
A large variety of parts may be ground on the standard machine. But there are a large number of special attachments that may be had to further increase the range of production. The wheelbase or headstock may be set at an angle. Should the work require it, crankheads may be had. Semi-automatic or full-automatic operation is obtainable. Straight infeed grinding is facilitated by the Landis hydraulic straight-infeed mechanism. Other types of work for which the machine is suitable are formed-wheel grinding and multiple-wheel grinding.

The hydraulic table traversing mechanism is of the twin-cylinder type. Volume of oil in the cylinders is constant, regardless of the direction of traverse. The result is smooth operation. Table speeds range from 6 to 240 in. per min. The wheel drive motor is mounted on an adjustable plate at the rear of the wheelbase, and drive from it to the end of the wheel spindle is by means of multiple V-belts. Standard equipment includes a 30x3x12-in. straight-side grinding wheel. The oil pump and water pump are mounted in line and are driven by a constant speed motor. Wheel feed is of the conventional Landis type with final movement through a long screw and bronze half nut. Automatic hydraulic wheel feed, which functions at each reversal of the table, may be supplied upon special order. A constant-speed motor drives the headstock. Six work speeds are available by changing pulleys and belts at the left-hand end of the head. Headstock drive motor is rated at ½ hp.; pump drive motor, 1 hp., and wheel drive motor, 10 hp. Net weight of the 10x18 in. machine, without motors, is 6,700 lb.



"Sav-Air" 4-Way Control Valve

The Q-C Engineering Products, 1310 Maple St., Detroit, Mich., has developed a 4-way "Sav-Air" valve of the poppet type, which obtains its name from the fact that air bled from the right-hand to the left-hand side of the piston will perform the return movement, no line



pressure being required. Thus, one-half of the cycle uses no air from the line.

When the operating handle is in the center position, all valves are closed, but both sides of the cylinder are connected through the valves. Movement of the operating handle to the first right-hand position opens the exhaust to the left-hand side of the cylinder and movement of the operating handle to the second right-hand position introduces full line pressure to the right-hand side of the piston to perform work. The left-hand side exhaust valve is fully open.

Moving handle back to the first right-hand position disconnects the line pressure from the right-hand side of the piston and closes the left-hand side exhaust valve. Further movement to the neutral position bleeds the air from the right-hand side of the piston to the left-hand side until pressure is equal on both sides of the piston. After passing the

neutral position towards the first left-hand position, the right-hand exhaust valve starts to open, and timing is such that this valve does not open until all air is bled. The air bled from the right-hand to the left-hand side of the piston performs the return movement, and no air is used from the line for the return movement, except if higher pressure than the bled air is required to perform a heavy operation. Unintentional use of high-pressure air from the line cannot be made as heavy spring pressure must be overcome to reach the second left-hand position.

A "Pedair" foot control valve is also available to permit the operator to use both hands for productive purposes and still afford means of applying air as required. It has such applications as an air blast for removal of chips on drill presses and screw machines.

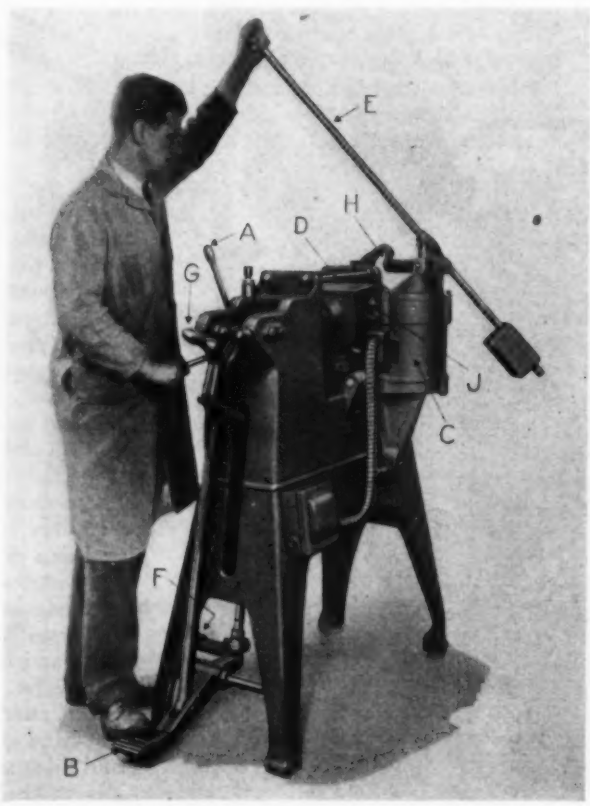
"Kipp-Caster" No. 15 Die-Casting Machine

For the economical production of comparatively small parts, the Madison-Kipp Corp., Madison, Wis., has added two more machines to its line of low-priced die-casting machines. These machines, supplementing the No. 11 (*AM*—Vol. 76, p. 984), are the Nos. 15 and 26. The No. 11 machine was intended for the production of parts in aluminum, duralumin, Nicralumin, magnesium and similar alloys. The No. 15 is intended for the production of zinc, lead and tin alloy parts. The No. 26 machine is a combination of the No. 11 and No. 15. The line of machines covers the casting problems of the job shop and of the small manufacturer, as well as of the large manufacturer who has diversified lines in which there are both small and large quantity runs.

The No. 15 machine is a side-shot type (metal enters at the side of the split-gate dies) and is equipped with an electrically heated metal pot and a plunger-loaded, metal-pressure gooseneck. This machine is semi-automatic in operation. As the die halves are locked shut, the metal pot and gooseneck are automatically rocked into casting position. The geared plunger lever is unlatched at this point so that it may be pulled down to force metal into the die cavity only at the proper time in the machine cycle. Core pulls are either automatic or hand-operated and casting ejection is automatic. The operator utilizes both hand and foot levers to make a complete cycle. Speeds of from three to eight shots per minute, depending upon the type of casting to be made, have been regularly maintained.

Standard die size for the Kipp-Caster machine series is 6x6x3 in. thick, but this die size may be varied for certain types of castings. Special ram heads can be provided for odd-shaped dies. The metal pot of the No. 15 holds 65 lb. of zinc alloy. A standard plunger will cast up to 1½ lb. of this alloy.

The accompanying illustration shows the combination No. 26 machine. The No. 11 is the same as illustrated, except for the omission of the electrically heated metal pot and plunger mechanism at the side, shown at *C*. The plunger operating handle for the No. 11 is shown at *G*. The No. 15 is furnished as shown except for the plunger handle *G* and the plunger assembly and metal well that go with it. Spoked wheel *A* closes the dies and rocks the metal pot *C* into casting position. Pedal *B* locks the dies. Metal pot *C* is electrically heated for casting zinc, lead and tin alloys. *D* indicates the dies over which there is a parting line guard. *E* is the plunger handle for No. 15 machine. *F* is the foot lever for unlocking and opening the die, and automatically rocks the metal pot *C* out of casting position. Trip *H* prevents plunger handle *E* from being operated until the dies are locked in the casting position. *J* is the goose-neck nozzle of the No. 15 machine. It is through this nozzle that metal is forced into the gate at the side of the dies.



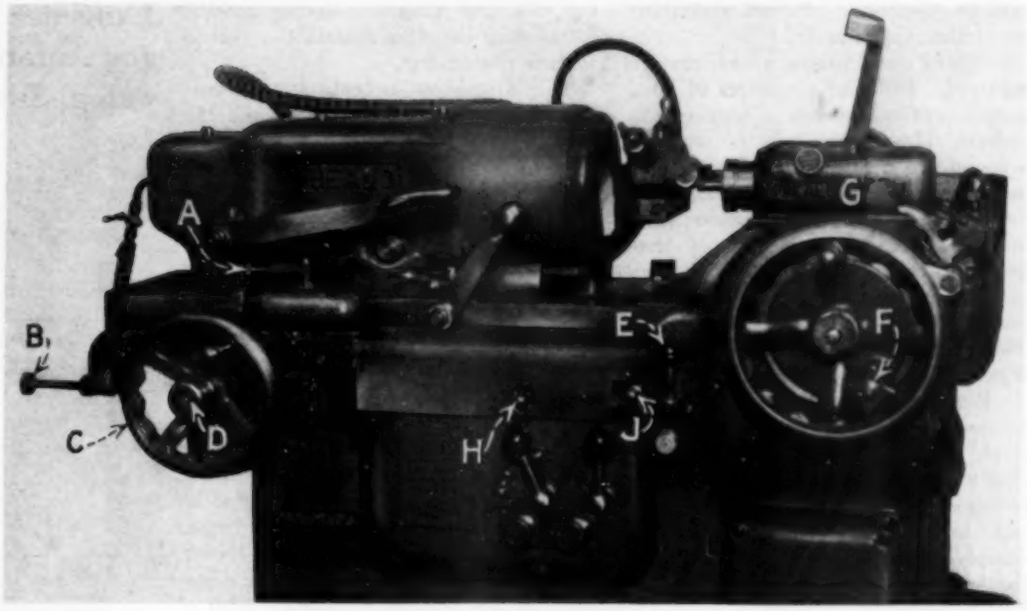
"Kipp-Caster" No. 26 Die-Casting Machine, which is a combination of the No. 11 and No. 15 machines. From 3 to 8 shots per minute can be made with the No. 15 machine, handling zinc, lead and tin alloys

Dual Control for Heald No. 81 Internal Grinder

The Heald Machine Co., Worcester, Mass., is now prepared to furnish its No. 81 small internal grinder with dual control, that is, employing the "Gage-Matic" and the "Size-Matic" principles. Gage-Matic sizing is done with solid positive gages working at the back end of the hole, and Size-Matic sizing where a taper hole or blind hole is encountered, when a cross-slide and truing device adjustment is made use of. In addition, the company has developed certain attachments designed to facilitate manual operation of the No. 81 machine where it would not be practical to set up the automatic features for very small lots.

On the dual control No. 81 machine, the plug sizing device is rendered inoperative when the machine is used as a Size-Matic, by means of a gage throw-out lever "A" in the accompanying illustration. The Size-Matic control mechanism is disconnected by lifting the bar which connects the feed box and the control box, and moving it to the right until a second notch engages the pin in the control lever.

Among the attachments developed to facilitate manual operation of the No.



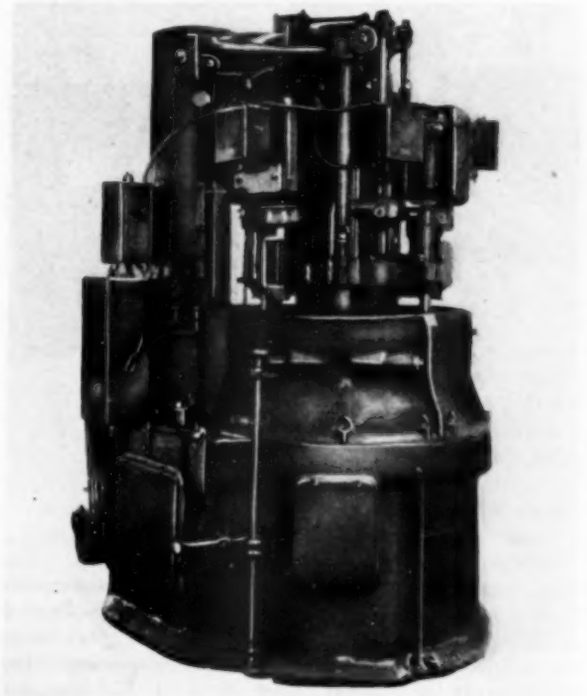
General view of Heald No. 81 Combination Gage-Matic and Size-Matic Internal Grinder with special slow-speed hand table feed and positive stop to table

81 machine is the control knob for setting the power cross feed. The feed control knob has been changed to permit the power feed to be disengaged without disturbing the normal setting, and to permit re-engagement of the feed without the necessity of a careful adjustment. By the use of a hand lever *E* for truing, many of the automatic functions of the machine are retained. Throwing this lever, runs out the table, drops the diamond, slows the machine truing speed, and at the conclusion of truing sets the control valve diminishing speed. Another device is the manual compensating cross-feed handwheel. A handwheel unit having a hand compensating knob *F* operates similarly to the hand compensating knob on the No. 72 machine. This unit is equipped with a positive stop for the cross feed to assist in holding size when grinding as a plain machine.

The ratchet operated hand cross feed is shown at *G*. This attachment feeds the cross slide one notch each time the handle is depressed. The manually operated quick return is shown at *J*. The adjustable positive stop of the table *B* prevents over travel when grinding blind holes. This unit can be attached to any No. 81 machine. The special slow speed hand table feed is of assistance in setting up or for occasional facing, since a sensitive feed has been found desirable. This is taken care of by a handwheel *C*. When this hand-feed unit is used, the hydraulic system is disconnected by knob *D*. A pair of reduction gears is arranged to give only ½ in. movement of the table for one turn of the handwheel. For grinding of long, small holes, where it is necessary to stroke the wheel by hand to straighten the hole, such a device is of convenience.

Baird Automatic Multiple-Spindle Internal Grinder

Internal grinding on a large quantity basis can be done with the multiple-spindle internal station-type grinder developed by The Baird Machine Co., Bridgeport, Conn. The machine illustrated has eight spindles, of which six are grinding stations and two may be used as loading and unloading stations. In addition, one of these extra stations may be used for loading and unloading and the other arranged as a polishing, gaging or testing station. The grinding wheels do not have to be of the same size nor are they dressed alike. Each wheel is automatically dressed and sized according to its requirements and independently of any other wheel. Also, the speed and feed of each wheel is independent of any other wheel. Any grinding wheel may be replaced at any



Application of the multiple-station principle to the Baird Internal Grinder permits large output. Capacity, work to 11 in. in diameter

point in the cycle without disturbing any of the other wheels.

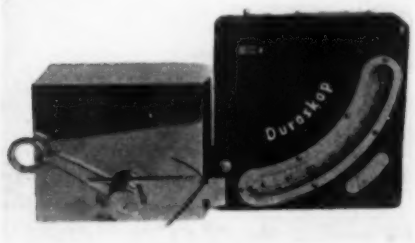
Roughing and finishing wheels may be employed. Different diameters of holes may be ground at one set-up of the machine. The machine may be arranged to operate as a double-indexing type so that a piece of work may be first ground from one end and at the second pass through the machine be ground from the other end, or two pieces of work may be unloaded and loaded at each cycle of operations.

Floor space is 74x61 in., and the height is about 106 in. Weight is 27,000 lb. Power requirements are 7½ hp. for the machine, and 2 to 3 hp. for each wheel, depending on the job. Capacity is for work up to 11 in. Totally inclosed mechanism, anti-friction bearings, automatic lubrication, and automatic safety controls are other features. A copious flow of coolant carries away heat and also the chips.

"Duroskop" Hardness Testing Instrument for Wire

The R. Y. Ferner Co., Investment Bldg., Washington, D. C., is now marketing a special form of the "Duroskop" hardness testing instrument (*AM*—Vol. 75, p. 792). This special "Duroskop" is offered for testing the hardness of wire and other cylindrical material of small size.

In this instrument the hardness is measured by the angle of rebound of a falling pendulum. For testing wires the usual spherical anvil of the hammer head



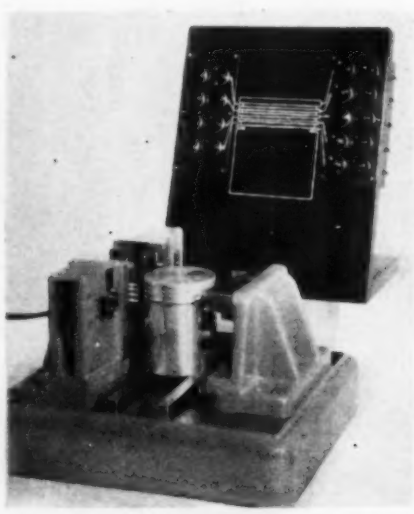
of the pendulum is replaced with a cylindrical anvil, the axis of which is parallel to the pendulum rod. Accordingly, the side of the cylinder strikes across the wire being tested when the latter is being held in a horizontal position. Rapid routine tests of wire are possible with this instrument, even with the wire in motion. A hardened steel block, with all the parts chromium-plated, has been designed with both flat and curved surfaces so that it can be used for both the testing of wire and drill rods. Two adjustable supports for the wire are provided, having notches for holding the wire against the curved surface during test.

The Duroskop is entirely self-contained in a case 4⅛ in. square and 1¼ in. thick. It weighs 13 oz. It can be used for testing wires as small as 0.004 in. or for cylindrical objects as large as 2 in. in diameter. The blow leaves only a microscopic mark on the surface.

"Electriclimit" Gage for Checking Several Diameters Simultaneously

The Gage Division, Pratt & Whitney Co., Hartford, Conn., has developed an electric gage for checking a number of diameters simultaneously. As shown, the gage is arranged to check nine diameters on an automotive piston. Five of these dimensions are outside diameters and four are groove diameters. Checking is done by means of electric contacts arranged to engage desired surfaces as the piston slides through. When the part is within the desired limits, no lights appear on the indicating board. If any dimension is oversize, the corresponding green light flashes on. If it is undersize, the red light appears.

It has been found that this gage has cut inspection time on automotive pistons by approximately 65 per cent. Moreoever, there is a definite increase in uniformity and quality of inspection. Application of the gage is widespread. It can be applied to any piece where one or a multiple number of dimensions are to be gaged, thus lumping several gaging operations in one, with consequent savings.



Nine diameters of an automotive piston are checked on this Pratt & Whitney "Electriclimit" gage simultaneously, and inspection time has been reduced 65 per cent

Langelier Swaging Machine for Automatically Straightening, Swaging and Cutting Wire

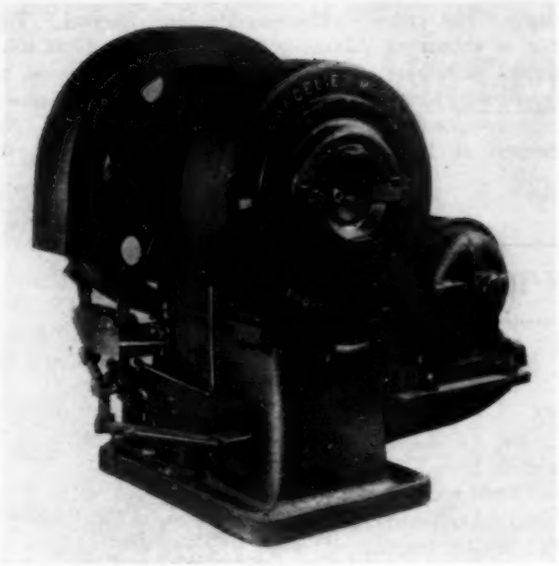
Wire is taken from the coil, straightened, swaged and cut to length in the machine illustrated, which has been developed by the Langelier Mfg. Co., Providence, R. I. Process is entirely automatic and production is at the rate of 20 pins a minute. Wire to 0.065 in. can be used, and pins up to ¾ in. long can be swaged and cut off.

The machine has a No. 1 swaging head, and the remainder of the top of

Wire to 0.065 in. can be used on this automatic Langelier swaging machine. Maximum length cut off is ¾ in.

the frame has a dovetail slide upon which the shearing, feeding and straightening heads are reciprocated by means of a double cam under the frame. The feeding and straightening heads are coupled together and act in unison. The shearing head is actuated by the feeding head, and its travel is controlled by adjustable stops.

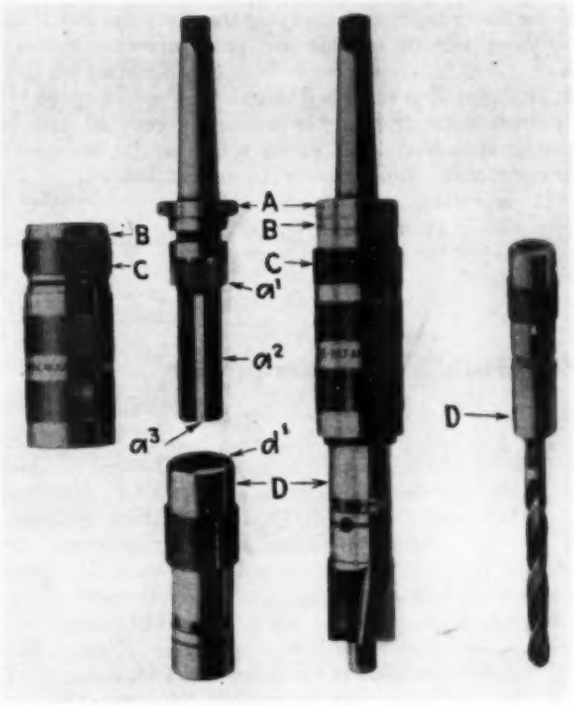
The feeding mechanism is made up of a double cam that actuates a pair of cam levers. These are connected to a pair of segment gears that mesh with racks located in the dovetail slide. One of the racks is connected to the feeding head; the other rack to a wire pinch-lever in the feeding head. Both cams are driven by a worm and wheel. The swaging head and the worm-shaft on the machine are driven from an overhead countershaft or the machine can be motorized if desired. Floor space required for the unit is 2x3 ft., and the weight is 900 lb.



Langelier Swaging Machine for Pointing Rods

The Langelier Mfg. Co., Providence, R. I., has completed a swaging machine for pointing copper and nickel silver rods preparatory to a drawing operation, to permit threading the stock through a die for gripping by the jaws. Three sets of dies were furnished to reduce ¾ in., ⅞ in. and ⅝ in. stock about 0.150 in. per pass for a length of 12 in. Production averaged about 400 ends per hour.

The machine is Timken-bearing equipped and has a pressure feed system for lubricating the operating parts in the head. Since a wide range of sizes of stock will be handled, the cover for the dies is made for quick removal. A flywheel brake is furnished to stop the rotation of the spindle immediately to minimize time required for changing tools. Drive is from a 15-hp. motor through V-belts. Floor space required is 52x60 in., over-all height is 56 in., and the weight is 5 tons.



Changes in length of end-cutting tools are quickly accomplished on the Eclipse "Micro-Justable" holder

Eclipse "Micro-Justable" Toolholder

Quick micrometer adjustment for length, by hand, in conjunction with a constant positive lock in any position are the principal features of the "Micro-Justable" toolholder recently developed by the Eclipse Counterbore Co., Detroit, Mich. This holder is offered for multiple-spindle operations involving accurate depths of counterbored, countersunk, drilled, reamed or tapped holes.

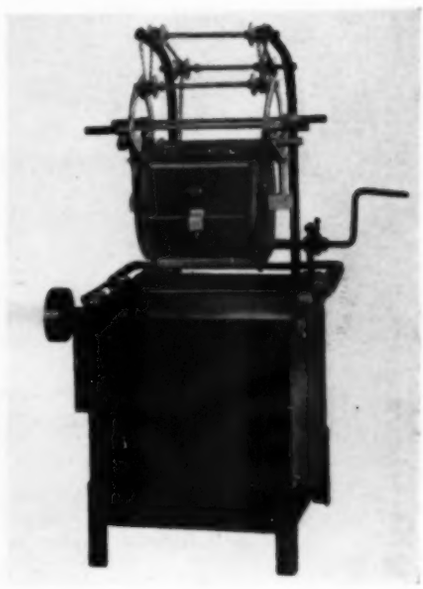
Referring to the illustrations, any change in length from 0.001 in. to 1¼ in. is accomplished by raising the knurled lock sleeve *C* by hand and then turning the adjusting sleeve *B*, and lowering the lock sleeve. Nothing more is required. A pawl located under the lock sleeve engages the serrations on the driving shank a^1 and locks the holder against any possible change in adjustment. The square stem a^2 provides a driving member in the broached hole d^1 of the cutter holding member or socket *D*. The circular ground corners a^3 provide alignment in the ground bearing in *D*. Thrust is taken by the adjusting sleeve *B* against the thrust flange on the driving shank *A*. Standard parts, except the cutter socket, are used throughout. Only the sockets shown at *D* and D^1 are changed when adapting the holder for use with different types of end-cutting tool shanks. D^1 shows the socket or lower end adapted for use with twist drills.

"Crescent" Stainless Tape Rule

The Lufkin Rule Co., Saginaw, Mich., has added to its line of tape rules the "All-Steel Crescent" No. S-696, which employs stainless steel for the blade, the sliding hook, and also for the case. This use of stainless steel makes the article rust-proof and non-corrosive. The 6-ft. rule is offered in marked inches to 16ths for general use.

Udylite "Maximus Junior" Plating Barrel

A plating machine suited in size and design for plants that have frequent small rush jobs has been developed by The Udylite Process Co., Detroit, Mich. The machine is a complete plating unit it itself. The tank is of heavy, welded-steel construction, and the removable cylinder in which the small parts to be plated are placed is of perforated Formica. A hand hoist and drain board



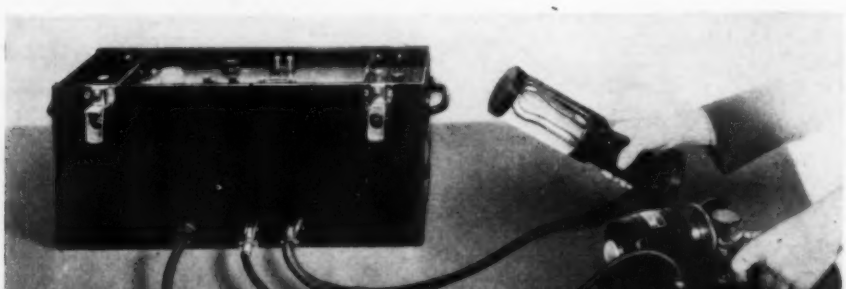
for raising the cylinder and emptying the load without loss of solution are provided.

The plating unit is furnished in either belt or direct motor drive and is supplied completely assembled with anode rods and connections. Tank size is 28 in. long, 21 in. wide, and 22 in. deep. Cylinder size is 12 in. diameter, 12 in. long. Weight of the machine is approximately 80 lb.

"Edgerton" Stroboscope

The General Radio Co., Cambridge A, Mass., is marketing the "Edgerton" stroboscope which can be used to detect trouble in the operation of machines and tools in the plant. Some of the suggested uses are: Study of contact and operation of gear teeth, including deflection under load; balancing of parts, such as rolls and slender shafts; study of vibration in tools, tool rests and tool holders; inspection of motors for balance and armature clearance while in motion; centering of parts, as in the chuck of a grinding machine; detection of causes of noise by study of moving parts; study of high-speed punch press operation; study of cam action, and study of pistons, valves, springs and other reciprocating parts.

The stroboscope is used in the observation of rapidly moving objects. It permits viewing such objects as though stationary or as though moving at relatively low speeds, so that their behavior at high speeds may be studied or photographed. The device consists of a mercury-vapor lamp capable of giving light flashes of short duration, high frequency and brilliant intensity. Equipment proper includes the lamp and power supply. The flash speed of the lamp can be controlled from a.c. lines by an oscillator or by the company's Type 549-A synchronous motor contactor. As shown, the stroboscope consists of the power supply (left) and the lamp. The synchronous motor contactor is shown at the right of the photograph. Minimum flashing speed is 5 flashes per sec., maximum, 30 flashes per sec., corresponding to fundamental synchronisms at 1,800 r.p.m.



Edgerton Stroboscope and accessories. The stroboscope consists of the power supply (left) and lamp. Synchronous motor contactor (right) is extra. It controls flash speed of the lamp

• PATENTS •

FEBRUARY 14, 1933

Metal-Working Machinery

Grinding Machine. Carl J. Anderson, Chicago, Ill., assigned to Erik Borg and Carl U. Johanson. Patent 1,897,035.

Tool Grinding Machine. Leonhard Kellenberger, St. Gallen, Switzerland. Patent 1,897,055.

Broaching Machine. John P. Ferris, Milwaukee, Wis., assigned to The Oilgear Co. Patent 1,897,386.

Die-Casting Machine. Torbjorn C. Korsmo, Madison, Wis., assigned to Madison-Kipp Corp. Patent 1,897,433.

Machine Tool Spindle. Frank O. Hoagland, West Hartford, Conn., assigned to Pratt & Whitney Co. Patent 1,897,666.

Tools and Attachments

Chuck and Centering Arbor. Harry S. Beckett, Pitman, N. J., assigned to The Hess-Bright Manufacturing Co. Patent 1,897,228.

Processes

Process of Making Forged Steel Wheels. Clarence S. Swanson, Chicago, Ill., assigned to Standard Forgings Co. Patent 1,897,646.

FEBRUARY 21, 1933

Metal-Working Machinery

Gear Cutter. Ernest C. Head, Rochester, N. Y., assigned to Gleason Works. Patent 1,898,051.

Riveting Machine. Samuel F. Tapman, Jamaica, N. Y. Patent 1,898,468.

Holddown for Punch Presses, Shears, or the Like. Frederick E. Munschauer, Buffalo, N. Y., assigned to Niagara Machine & Tool Works. Patent 1,898,565.

Broaching Machine. John P. Ferris, Milwaukee, Wis., assigned to The Oilgear Co. Patent 1,898,576.

Automatic Grinding Machine. Peter Thorsen, North Bergen, N. J., and George William Von Hofe, Forest Hills, N. Y., said von Hofe assigned to said Thorsen. Patent 1,898,648.

Die Casting Machine. William M. Lester, Shaker Heights, Ohio. Patent 1,898,671.

Automatic Lathe. Otto Schaerer, Basle, Switzerland. Patent 1,898,902.

Flame Cutting Burner Apparatus. Leslie John Hancock, Sutton, England. Patent 1,898,955.

Tools and Attachments

Blank Feeder for Forging Machines. Charles L. West, Tiffin, Ohio, assigned to D. R. Lindley. Patent 1,898,279.

Processes

Method of Gear Cutting. Nikola Trbojevich, Detroit, Mich. Patent 1,898,154.

Crank Shaft Balancing. Edward C. Newcomb, North Scituate, Mass. Patent 1,898,459.

• TRADE PUBLICATIONS •

GRINDERS. The M. C. Tool Co., 114 S. Aberdeen St., Chicago, Ill., has issued a new catalog on the "Hand-ee" grinder which weighs about 1 lb. The catalog shows industrial applications of the device and illustrates the numerous sizes and shapes of grinding wheels available.

MOTOR REDUCTION UNIT. Bulletin 1164, issued by Allis-Chalmers Mfg. Co., Milwaukee, Wis., describes the company's motor reduction units and gives sectional views.

PHOSPHOR BRONZE. "Anaconda Phosphor Bronze," publication B-15, Second Edition, is now available from the American Brass Co., Waterbury, Conn. Physical properties, grades, and commercial shapes of this alloy are discussed.

TANK LININGS. Stebbins Engineering & Mfg. Co., Watertown, N. Y., has issued "Stebbins Linings," a publication describing its specialized lining service which includes the lining of pickling tanks and plating tanks with corrosion-resistant materials.